

**GSA RECLAMATION YARD, SWMU NO. 010  
SOUTHWEST HOT SPOT INTERIM MEASURE  
PERFORMANCE MONITORING REPORT  
KENNEDY SPACE CENTER, FLORIDA**

**Prepared for:**



**National Aeronautics and Space Administration  
Kennedy Space Center, Florida**

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**ABBREVIATIONS AND ACRONYMS**

bgs	below ground surface
cis-1,2-DCE	cis-1,2-dichloroethene
CORE	CORE Engineering & Construction, Inc.
DNAPL	dense non-aqueous phase liquid
DPT	direct push technology
ERD	Enhanced Reductive Dechlorination EVS      Environmental Visualization System
EZVI	emulsified zero valent iron
FDEP	Florida Department of Environmental Protection
ft.	feet, foot
GCTL	Groundwater Cleanup Target Level (Chapter 62-777, Florida Administrative Code)
GSA	General Services Administration
GSRY	GSA Reclamation Yard
IM	interim measure
KSC	Kennedy Space Center
NADC	natural attenuation default concentration
NASA	National Aeronautics and Space Administration
PCE	tetrachloroethene, also known as perchloroethylene
TCE	trichloroethene
TDS	total dissolved solids
TRPH	total recoverable petroleum hydrocarbons
UIC	Underground injection control
µg/L	micrograms per liter
µmol/L	micromoles per liter
VO/L	vegetable oil/lactate solution
VOC(s)	volatile organic compound(s)

## EXECUTIVE SUMMARY

This report presents an evaluation of performance groundwater monitoring activities associated with implementation of an interim measure (IM) conducted in November 2013 for a groundwater contamination hot spot at the General Services Administration (GSA) Reclamation Yard (or GSRY) at Kennedy Space Center (KSC), Florida. This report also summarizes corresponding baseline sampling that was completed in December 2012 and April-May 2013.

Referred to as the Southwest Hot Spot because of its location in the yard, the shallow subsurface was affected by tetrachloroethene (PCE) at concentrations of 300 micrograms per liter ( $\mu\text{g/L}$ ) or higher across an area of about 0.12 acres. The Southwest Hot Spot is the source of a plume of volatile organic compounds (VOCs) that extends across the west side of the Reclamation Yard.

Enhanced reductive dechlorination was selected as the technology for the Hot Spot treatment. Emulsified zero valent iron (EZVI) was chosen for treatment of the area where PCE concentrations were 10,000  $\mu\text{g/L}$  or higher (source zone), with a solution of vegetable oil and lactate (VO/L) injected where PCE concentrations were above 300  $\mu\text{g/L}$  (hot spot). The objectives of the IM were to reduce PCE mass in the source zone and to promote reduction of all VOCs in the hot spot.

The Southwest Hot Spot injections took place in November 2013. In total, 9,060 gallons of EZVI, and 26,000 gallons of VO/L solution were injected in the area where PCE concentrations were above 300  $\mu\text{g/L}$ , at depths from 11 to 27 feet (ft.) below ground surface.

Performance monitoring began in July 2014, approximately eight months after the injections, to track progress of reductive dechlorination and evaluate effectiveness of the IM. A second sampling event took place in March 2015. Samples were analyzed for PCE, trichloroethene, cis-1,2-dichloroethene and vinyl chloride. Based on results from the baseline sampling event and the second performance monitoring event, the volume of the plume exceeding 10,000  $\mu\text{g/L}$  (PCE concentration) has reduced by 93%. The volume of the plume exceeding 300  $\mu\text{g/L}$  for PCE has reduced by 88%. In addition, performance monitoring results at perimeter locations do not indicate contaminant movement based on pre- and post-IM results and comparison of molar concentrations at baseline and in March 2015.

Underground injection control (UIC) parameters exceeded applicable screening criteria during both performance monitoring events, which indicate that groundwater plume conditions have not reached pre-injection conditions.

As agreed to by the KSC Remediation Team during the July 2015 Team Meeting, a third performance event is taking place in November 2015. The same locations will be sampled, plus an additional location 10 ft. west of the southwestern performance monitoring location (DPT3021), as a sentinel to monitor for potential movement of mass from injection activities. Results will be compared to baseline and prior performance monitoring results to monitor progress of the IM. Data will also be evaluated to determine whether supplemental treatment to further enhance reductive dechlorination is warranted.

## **Section 1**

### **INTRODUCTION**

#### **1.1 OVERVIEW**

The National Aeronautics and Space Administration (NASA), through its Environmental Assurance Branch, is managing the investigation and cleanup of environmental contamination at the General Services Administration (GSA) Reclamation Yard at Kennedy Space Center (KSC), Florida, Solid Waste Management Unit No. 010. As part of the cleanup process, NASA completed an Interim Measure (IM) to treat a chlorinated solvent hot spot located in the southwest corner of the site (the Southwest Hot Spot). This IM effort, including preparation of this Performance Monitoring Report, was completed by Jacobs Engineering Group Inc. and CORE Engineering & Construction, Inc. (Jacobs-CORE) under Contract No. NNK12CA14B, Order No. NNK12CA51T.

The results of two performance monitoring events, as described herein, were presented to the KSC Remediation Team during the July 2015 Team Meeting as part of the Step 4 Engineering Evaluation process. Meeting minutes from this presentation are included in Appendix A.

#### **1.2 BACKGROUND**

The GSA Reclamation Yard is located in Brevard County, on Ransom Road between State Road 3 and Space Commerce Way (Figure 1-1). The facility is used for the cataloguing, temporary storage and sale/recycling of surplus equipment and materials from operations at KSC. Buyers and vendors remove items from the site regularly for reuse, recycling, parts, or disposal. Several times a year, public auctions are held at the facility.

The site name, GSA Reclamation Yard, or GSRY, is a carryover from the time environmental investigations began. The facility is currently operated by KSC's Institutional Support Contractor and is called the Reutilization, Recycling and Marketing Facility. The main part of the site, which is also where this recent IM was implemented, is a fenced compound housing several buildings and the equipment storage/display yard. The largest structure in the Reclamation Yard is the Surplus Storage and Disposal Building (Facility M6-1671), which sits near the south fenceline. Personnel occupy this facility throughout the work day. Near the center of the yard is a storage shed (M6-1621), which is not routinely occupied. The same is true of the Hazardous Waste Staging Shelter (M6-1671B) and the Hazardous Material Staging Building (M6-1671C). The northeast portion of the yard is paved with asphalt; the remainder has a gravel finish or – along the western fenceline – is bare earth. A security fence encloses the GSA Reclamation Yard, which is locked after duty hours. The single entrance to the GSA Reclamation Yard is from Ransom Road. Ransom Road borders the site to the north, with retention ponds on either side of the entrance. A drainage ditch encircles the other three sides of the site, merging into a normally dry stormwater retention feature at the northeast. To the east of the site is KSC's Corrosion Control Facility. To the west is the Reclamation Facility's scrap storage yard. The south is bounded by undeveloped land. Figure 1-2 provides an overview of the site and surrounding features.

Past handling practices resulted in releases of dielectric fluid and solvents to the environment at the site, which led to two distinct areas and types of contamination. In the southwest corner of the yard, tetrachloroethene (PCE) and possibly trichloroethene (TCE) were discharged. Both of those solvents, as well as other volatile organic compounds (VOCs) created by their degradation, affect groundwater at that location; the associated plume extends northerly along the west side of the site.

Corrective measures were implemented in 2006 to excavate solvent-impacted soil in the southwestern area of the site down to 16 feet (ft.) below ground surface (bgs); sodium permanganate was added during the backfill process to chemically oxidize additional chlorinated VOCs (Jacobs, 2006). In 2007, direct injections of sodium permanganate were performed in the western area of the site to address rebounding PCE concentrations in groundwater. Long term monitoring (LTM) of groundwater was initiated after corrective measures activities were completed in 2006-2007. Groundwater monitoring results continued to identify an increasing trend of VOCs with concentrations exceeding applicable cleanup target levels and/or Natural Attenuation Default Concentration (NADC) values. As a result, LTM was suspended and additional investigations were initiated in the southeastern and western areas of the site (ARCADIS, 2011 and 2012). A Supplemental Site Assessment was performed in these areas between 2008 and 2010.

In 2011, results from the Supplemental Site Assessment were reported to the KSC Remediation Team as a Step 1 Engineering Evaluation, as part of the KSC Engineering Evaluation Process. Subsequently, a Step 2 Engineering Evaluation was performed to evaluate alternatives for remediating PCE concentrations indicative of dense non-aqueous phase liquid (DNAPL) in groundwater; Enhanced Reductive Dechlorination (ERD), through an injection program, was selected as the treatment method. In 2012, the KSC Remediation Team reached team consensus on the Step 3 Engineering Evaluation, including an IM Work Plan (ARCADIS, 2012); this IM Work Plan was approved by the Florida Department of Environmental Protection (FDEP) on August 1, 2012. A Southwest Hot Spot IM Implementation Work Plan (Jacobs-CORE) was later issued in October 2013 (using the 2012 IM Work Plan as a basis), which documented baseline sampling results used to finalize ERD IM treatment plans.

### **1.3 INTERIM MEASURE OBJECTIVES**

The recent Southwest Hot Spot IM was a step in the overall cleanup process of the site. The objective of the IM was two-fold:

- First, to reduce significant contaminant mass (PCE as DNAPL, sorbed and/or dissolved form) in the source zone (area with known or suspected DNAPL) and hot spot (the area where PCE concentrations were more than ten times its NADC). The PCE acts as a continuing source of dissolved VOCs in groundwater. If left untreated, these high concentrations of PCE could feed an expanding plume and most certainly extend the overall treatment time of the site by many years.

- Second, to accelerate biodegradation processes within the high concentration plume (where PCE levels were greater than its NADC) to promote degradation of the overall plume and reduce the time for site cleanup.

To achieve these objectives, a combined emulsified zero valent iron (EZVI) and vegetable oil/lactate (VO/L) injection approach was selected for implementation. EZVI directly targets the PCE DNAPL in the source zone by taking advantage of their similar physicochemical characteristics (i.e., hydrophobic nature provides miscibility between EZVI and DNAPL) and the unique ability to emplace reactive ZVI in water within a DNAPL zone. The EZVI injected into the source zone destroys chlorinated ethenes through both biotic and abiotic reductive dechlorination processes. The VO/L solution serves as both a sequestering agent for the source area and a fermentable substrate for existing bacteria, enhancing the degradation of the dissolved phase plume as it migrates from the source area.

## **1.4 TREATMENT ACTIVITIES**

The IM was based on enhanced reductive dechlorination, using injection of EZVI and a VO/L solution as means to reduce VOC concentrations at the site, as well as to accelerate attainment of groundwater cleanup target levels (GCTLs). Following baseline sampling (described in Section 2.1), EZVI and VO/L injection activities were completed between November 15-26, 2013. EZVI was injected into the “Primary Source Area,” defined where PCE concentrations exceeded 10,000 micrograms per liter ( $\mu\text{g/L}$ ). A VO/L solution was injected into the hot spot (secondary source area), defined where PCE concentrations were between 300 and 10,000  $\mu\text{g/L}$ .

A total of 9,060 gallons of EZVI was injected at 28 locations, with an expected radius of influence (ROI) of 6 ft. based on prior results in similar formations, as shown on Figure 1-3. However, the EZVI points were laid out on 5 ft. centers to be conservative. VO/L solution (26,000 gallons) was injected at 13 locations encircling the EZVI treatment area (Figure 3). The VO/L points were on 12 ft. centers, with solution injected between 12 and 27 ft. bgs. The total area treated with EZVI and VO/L was approximately 0.12 acres (5,200 square feet), with varying intervals treated between 11 to 27 ft. bgs. A detailed description of the treatment activities can be found in the Implementation Report (Jacobs-CORE, 2014).

## **1.5 PERFORMANCE MONITORING OBJECTIVE**

The objective of performance monitoring is to evaluate the effectiveness of the IM. Performance monitoring was performed in July 2014 (eight months post-injection) and in March 2015 (sixteen month post-injection). Sample locations mirrored select locations from the baseline sampling event, so that effectiveness of the IM could be evaluated by comparing the baseline (pre-injection) data with the performance (post-injection) data.

As outlined in the IM Work Plan (ARCADIS, 2012), underground injection control (UIC) parameter collection will continue until targets established in the work plan are met. The targets are:



- Total recoverable petroleum hydrocarbons (TRPH) - Two consecutive sampling events are below FDEP GCTL criteria (5,000 µg/L),
- Iron - below baseline sampling results or KSC Upper Range of Background, and
- Total dissolved solids (TDS) - below baseline sampling results or KSC Upper Range of Background.

## **1.6 PURPOSE**

This Performance Monitoring Report presents a summary of both the baseline and performance monitoring events. It includes groundwater performance monitoring analytical results, an evaluation of results, and recommendations for future activities at the site.

## **1.7 PERFORMANCE MONITORING REPORT ORGANIZATION**

The remainder of this report is organized as follows:

Section 2: *Performance Monitoring Activities* – This section includes a brief discussion of baseline sampling activities, and provides a summary of the eight (Event 1) and 12 months (Event 2) post-injection sampling events.

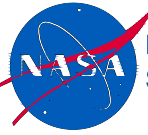
Section 3: *Performance Monitoring Results* – This section provides a summary of results for select baseline samples, as well as results performance monitoring Event 1 and Event 2.

Section 4: *UIC Sampling and Results* – UIC sampling and results from the three sampling events (baseline, Event 1 and Event 2) are presents in this section.

Section 5: *Conclusions and Recommendations* – This section provides conclusions and recommendations to continue to evaluate the effectiveness of the IM.

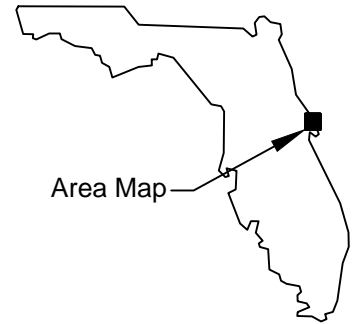
Section 6: *References* – This section provides a listing of references cited in this report.

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Prepared By: R.Ashton  
Date: 09/26/2013  
Ref: GSA\_WP LocMap.dwg



NATIONAL AERONAUTICS AND  
SPACE ADMINISTRATION

Figure 1-1  
GSA Reclamation Yard  
Site Location



Area Map

Atlantic Ocean

Kennedy Space  
Center

Cape Canaveral  
Air Force Station

Site Location

SR406

Kennedy Parkway North

SR405

Space Commerce Way

Ransom Road

NASA Parkway

SR3

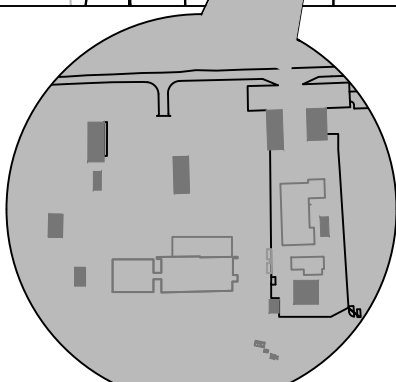
Banana River

Phillips Parkway

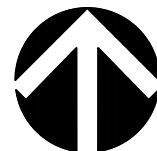
SR401

SR528

A1A



Enlarged View



0 1 2 3 4  
SCALE: 1" = 2 Miles

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- Legend**
- Southwest Hot Spot Treatment Area
  - Facility/Structure
  - Pavement
  - Water Filled Detention Pond and Drainage Ditch
  - Retention Pond
  - Existing Chain Link Fence
  - Gravel / Dirt Road
  - Culvert Crossing
  - Fire Hydrant
  - Monitoring Wells Abandoned During the IM

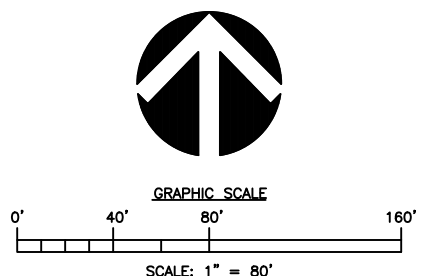
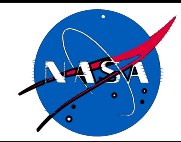


Figure 1-2

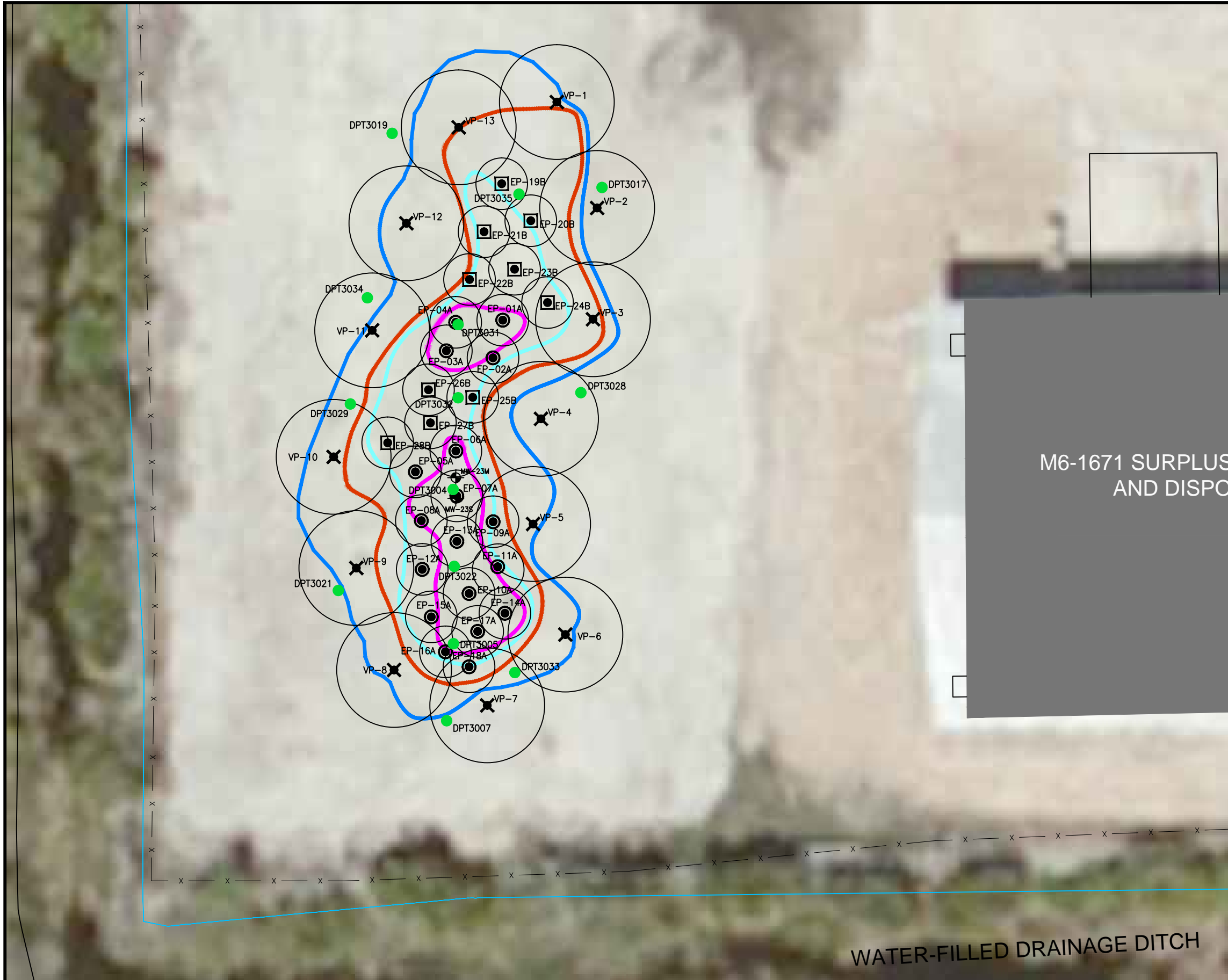
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GSA Reclamation Yard  
Southwest Hot Spot Interim Measure  
Site Layout

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**Legend:**

- 10% EZVI injection Points
- 15% EZVI injection Points
- 6% Vegetable Oil / Lactate Injection Points
- DPT Groundwater Sampling Locations
- Proposed DPT Sampling Locations

PCE Concentration in ug/L

- 300 ug/L
- 3,000 ug/L
- 10,000 ug/L
- 30,000 ug/L

Isopleths are inferred.

Denotes approximate Radius of Influence

Existing Chain Link Fence

Water Filled Drainage Ditch

Facility/Structure

M6-1671 SURPLUS  
AND DISPOSAL

WATER-FILLED DRAINAGE DITCH

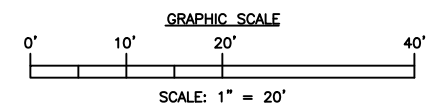
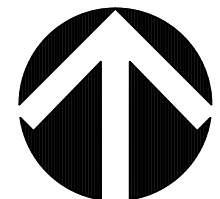
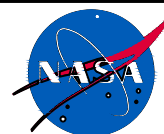


Figure 1-3

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**NATIONAL AERONAUTICS AND  
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**GSA Reclamation Yard  
Southwest Hot Spot Interim Measure  
Injection Points and Performance Monitoring Sample Locations**

## **Section 2**

### **PERFORMANCE MONITORING ACTIVITIES**

Groundwater sampling activities from December 2012 to March 2015 were performed in accordance with the scope of work and the GSRY Southwest Hot Spot Implementation Report (Jacobs-CORE, 2014). All field activities and reporting associated with these sampling events were conducted in accordance with the latest Standard Operating Procedures approved by FDEP and with the KSC *Sampling and Analysis Plan for the Resource Conservation and Recovery Act (RCRA) Corrective Action Program*.

Groundwater samples were collected in sample containers provided by the analytical laboratory. Mobile laboratory services were provided by Analytical Laboratory of Florida (ALF) of Merritt Island, Florida. Fixed laboratory services were provided by Environmental Conservation Laboratories of Orlando, Florida. Upon sample collection, all samples were immediately labeled and placed on ice.

Direct push technology (DPT) sample locations are shown in Figure 3, along with injection points and the presumed radius of influence for the injected materials. Field forms are attached in Appendix B.

#### **2.1 BASELINE SAMPLING**

Baseline groundwater sampling was completed in December 2012 and April-May 2013. This data was used to confirm and refine the limits of the PCE hot spot and source zone, and to finalize the treatment area, horizontally and vertically. It also established a baseline data set to evaluate treatment efficacy by comparing baseline data (pre-injection) with performance monitoring data (post-injection).

Baseline groundwater sampling was completed by collecting discrete, multi-incremental groundwater samples via DPT. In total, 191 discrete samples were collected from 35 DPT locations between the two sampling events. Groundwater samples were collected from a vertical profile focusing on intervals between 7 and 31 ft. bgs, and analyzed for VOCs using Method 8260B. Most of the groundwater samples were collected using a 4-foot long screen point sampler, but 1-foot screen intervals were used at three locations (DPT3004, DPT3005, and DPT3031) to give a more precise picture of vertical PCE distribution. Following data collection, each DPT location was grouted, and the surface was re-finished to match existing grade. Details of the baseline sampling event are provided in the Implementation Report (Jacobs-CORE, 2014).

#### **2.2 PERFORMANCE MONITORING SAMPLING**

Performance monitoring was performed to determine if the remedy is working as expected. Event 1 was completed in July 2014 (eight months post-injection) and Event 2 was completed in March 2015 (sixteen months post-injection). To the extent practical, samples were collected via DPT from select locations and intervals of groundwater samples collected during the baseline sampling

event in order to support the performance assessment. Following sample collection, each DPT location was grouted from bottom to top using a tremie pipe. Performance monitoring samples were analyzed by mobile laboratory or fixed laboratory using Method 8260B for a set of target VOCs: PCE, TCE, cis-1,2-dichloroethene (cis-1,2-DCE), 1,1-DCE and vinyl chloride.

During Event 1, five locations inside the treatment area were sampled: DPT3004, DPT3005, DPT3029, DPT3031, and DPT3035. Four of the points were in the axis of the EZVI treatment area (from north-to-south, DPTs 3035, 3031, 3004 and 3005). DPT3029 was selected as representative of the VO/L treatment area beyond the expected ROI of EZVI injections. Up to four discrete sample intervals, using a four-ft. screen point sampler, were collected from each location. The depths of discrete collection ranged from 11 to 28.5 ft. bgs. Soil samples were also collected from 11 to 31 ft. at three locations for the purpose of observing whether EZVI was visually present.

As part of Event 2, sample locations inside the treatment area: DPT3004, DPT3005, DPT3029, DPT3031, and DPT3035 consistent with the first sampling event were sampled. In addition, to assess if perimeter movement of contamination had occurred, five other locations were sampled: DPT3007, DPT3017, DPT3019, DPT3028, and DPT3034 during Event 2. Also, four additional locations were sampled: DPT3021, DPT3022, DPT3032, and DPT3033 to provide better resolution inside the treatment area. Up to four discrete samples per location were collected between 11 and 28.5 ft. bgs at eight locations. Five discrete samples were collected between 7 and 27 ft. bgs at four locations, and six discrete samples were collected between 7 and 35 ft. bgs at two locations. The groundwater samples were collected using a 4-foot long screen point sampler.

### **Section 3**

## **PERFORMANCE MONITORING RESULTS**

Performance monitoring data establish the framework to evaluate the effectiveness of the GSRY IM. By comparing results from baseline sampling to performance monitoring data, the degree and rate of contaminant reduction is evaluated. This is used to assess progress toward the IM goal of significant mass reduction. Based upon mass reduction through both biotic and abiotic dechlorination processes, it is understood that the full achievement of the goal could take years to realize.

A summary of results for PCE, TCE, cis-1,2-DCE, and vinyl chloride from the baseline sampling event through the second performance monitoring event is presented in Table 3-1. Figure 3-1 shows the performance monitoring sample locations with a summary of results for the baseline sampling and subsequent events. Five sampling locations are within the EZVI treatment area (DPT3031, DPT3032, DPT3004, DPT3022 and DPT3005), four sampling locations are within the VO/L treatment area (DPT3035, DPT3029, DPT3021 and DPT3033), and five are at the treatment area perimeter (DPT3019, DPT3017, DPT3034, DPT3028 and DPT3007).

### **3.1 RESULTS SUMMARY**

#### **3.1.1 Baseline Sampling**

As noted in Section 2.1, 35 locations were included in the baseline sampling event in order to refine understanding of PCE concentrations and distribution within the hot spot. This subsection presents the baseline sampling results only for the 14 baseline sampling locations that have subsequently been used for performance monitoring events. In December 2012 and April-May 2013, a total of 72 VOC samples were collected from these 14 locations as part of the baseline sampling event.

Inside the treatment area, PCE, TCE, cis-1,2-DCE, and vinyl chloride concentrations exceeded their respective GCTL at all nine locations sampled. The highest PCE concentration of 170,000 µg/L was detected at DPT3005 (15-19 ft. bgs). PCE product was encountered in the 21-22 ft. bgs interval at DPT3005. The maximum TCE concentration was 16,000 µg/L (DPT3004, 17-18 ft. bgs). The highest cis-1,2-DCE and vinyl chloride results were also detected at DPT3004 (8,000 µg/L and 6,100 µg/L, respectively at 16-17 ft. bgs).

PCE exceeded its GCTL at all but one perimeter location (DPT3017) sampled. TCE was not detected at DPT3007 and cis-1,2-DCE was detected below the GCTL at this same perimeter location. Both analytes were detected above their respective GCTLs at the other three perimeter sample locations (DPT3019, DPT3028, and DPT3034). In addition, exceedences of vinyl chloride were observed at all five perimeter locations.



### **3.1.2 Performance Monitoring Sampling – Event 1**

A total of 20 VOC groundwater samples were collected from five DPT locations in July 2014. PCE concentrations exceeded its GCTL in all four samples collected from DPT3005. DPT3005 also exhibited the highest PCE concentration of 16,000 µg/L (19-23 ft. bgs). PCE was also detected above GCTL at DPT3029 (670 µg/L, 15-19 ft. bgs) and DPT3031 (35 µg/L, 19-23 ft. bgs). In addition, TCE concentrations were detected above the GCTL at these same locations and intervals. The maximum TCE result during this monitoring event was 5,000 µg/L (DPT3005, 15-19 ft. bgs).

Cis-1,2-DCE was detected above its GCTL in all four sample intervals at DPT3005, in two samples collected from DPT3031, and in one sample collected from DPT3004, DPT3029, and DPT3035. The highest concentration was 16,000 µg/L (DPT3005, 15-19 ft. bgs).

Vinyl chloride concentrations exceeded the GCTL in all 20 samples collected during this event, with a maximum concentration of 17,000 µg/L (DPT3005, 15-19 ft. bgs).

In July 2014 at DPT3005, a sample was collected from the 11-15 ft. interval to establish a benchmark for possible vertical migration above the treatment zone.

The three soil cores collected from the area of EZVI injection (Figure 3-1) were observed for the visible presence of EZVI. At cores EZVI-01 and EZVI-02, EZVI was observed at 17-17.5 and 18 ft. bgs, respectively. No EZVI was visible in the EZVI-03 core. These observations were qualitative only.

### **3.1.3 Performance Monitoring Sampling – Event 2**

In March 2015, a total of 64 VOC groundwater samples were collected from 14 DPT locations inside or at the perimeter of the treatment area. PCE concentrations exceeded its GCTL in all six samples collected from DPT3005, inside the treatment area. Of the other locations sampled inside the treatment area, PCE was detected above the GCTL at one or two intervals at DPT3004, DPT3021, DPT3022, DPT3031, DPT3033, and DPT3035. The maximum PCE concentration was 16,000 µg/L (DPT3005, 23-27 ft. bgs). PCE was not detected in any of the perimeter locations.

TCE concentrations exceeded the GCTL at four depth intervals at DPT3005, with a maximum concentration during the event of 6,000 µg/L (19-23 ft. bgs). Four other locations inside the treatment area (DPT3004, DPT3022, DPT3031 and DPT3033) had one sample each with TCE concentrations above the GCTL. TCE was not detected in any of the perimeter locations sampled.

Cis-1,2-DCE was detected above its GCTL in four of the six samples at DPT 3005. One sample from each of three other treatment area locations (DPT3022, DPT3029 and DPT3033) had cis-1,2-DCE concentrations above the GCTL. One perimeter sample (DPT3019, 15-19 ft. bgs) exceeded the GCTL. The highest concentration was 5,700 µg/L (DPT3005, 19-23 ft. bgs).



Vinyl chloride concentrations exceeded the GCTL in 54 of the 64 samples collected during this event, with a maximum concentration of 25,500 µg/L (DPT3005, 19-23 ft. bgs).

In March 2015 at DPT3005 (31-35 ft. bgs) and DPT3032 (27-31 ft. bgs), samples were collected to establish benchmark for possible vertical migration below the treatment zone. Similarly, the 7-11 ft. bgs interval at DPT3028 was sampled for the first time as a benchmark for lateral migration above the treatment interval.

## **3.2 TREND ANALYSIS**

Based on historical and current trends, VOC concentrations generally decreased in both the source zone and hot spot areas. The trends are discussed below based on treatment protocol. For purposes of overall trend evaluation, baseline results are compared to Event 2 (March 2015) results. Trend charts for select VOCs for the four DPT locations that were sampled during all three sampling events are included in Appendix C.

### **3.2.1 EZVI Treatment Area**

EZVI was applied to the portion of the Southwest Hot Spot where PCE concentrations were 10,000 µg/L or higher. Five DPT performance sampling locations are within that area; from north to south: DPT3031, DPT3032, DPT3004, DPT3022 and DPT3005 (Figure 3-2). In the four northerly locations, PCE and TCE levels have decreased by 1 to 2 orders of magnitude at all intervals. At the southernmost point, DPT3005, where product was observed during baseline sampling, PCE decreased by 1 order of magnitude in the 19-23 and 27-31 ft. bgs intervals, and by 2 orders of magnitude in the 15-19 ft. bgs interval. In the 23-27 ft. bgs interval, PCE concentrations increased by an order of magnitude between December 2012 and March 2015. The levels of TCE declined in the 15-19 ft. bgs interval, and increased in the 19-23 and 23-27 ft. bgs intervals.

The concentrations of cis-1,2-DCE have decreased at all intervals in all locations of the EZVI treatment area with the exception of DPT3005. In the 11-15 ft. bgs interval, which was not included in baseline sampling, the concentration is essentially unchanged. After rising by an order of magnitude in the first performance monitoring event, cis-1,2-DCE had decreased to an order of magnitude less than baseline in the 15-19 ft. interval in March 2015. There is an increasing trend in the 19-23 and 23-27 ft. intervals, and no change of the very low concentration in the 27-31 ft. interval.

Vinyl chloride levels in the two northerly points (DPT3031 and DPT 3032) were either lower or about the same as baseline in March 2015 in all intervals with baseline results. In March 2015 at DPT3004, vinyl chloride concentrations at all intervals were less than at baseline. At DPT3005 and 3022, vinyl chloride has increased compared to baseline at most intervals.

### **3.2.2 VO/L Treatment Area**

A VO/L solution was injected into the hot spot (secondary source area), as defined by PCE concentrations between 300 and 10,000 µg/L. Four DPT performance sampling locations are within this area; from north to south: DPT3035, DPT3029, DPT3021 and DPT3033 (Figure 3-3). In the three northern locations, PCE decreased at all locations where it had been detected in baseline at all but one interval at one location (DPT3021, 15-19 ft. bgs). At that point, it increased from non-detect to 8 µg/L. TCE was not detected in any of the intervals at these three locations in March 2015. At the southernmost point, DPT3033, PCE increased slightly in the 7-11 ft. bgs (non-detect to 2.6 µg/L), 15-19 ft. bgs (non-detect to 9.5 µg/L) and 19-23 ft. bgs (non-detect to 2.2 µg/L) intervals and TCE had a small increase in the 15-19 ft. bgs interval (non-detect to 1.8 µg/L).

Cis-1,2-DCE decreased in all intervals in the three northerly points, except where it was relatively unchanged compared to baseline at levels below its GCTL. On the south, at DPT3033, its concentrations were relatively unchanged between 7-15 ft. bgs. There were increases compared to baseline between 15-27 ft. bgs, but all concentrations are below 10 µg/L (compared to a GCTL of 70 µg/L).

Vinyl chloride trends are downward at the three shallower intervals at DPT3035, with an upward trend in the deepest interval (23-27 ft. bgs). At the three southerly points in the VO/L treatment area, vinyl chloride has trended upward at most intervals. Compared to the EZVI treatment area, vinyl chloride trends are more gradual in the VO/L treatment area.

### **3.2.3 Treatment Area Perimeter**

Five DPT performance sampling locations are at the perimeter of the treatment area; from north to south: DPT3019, DPT3017, DPT3034, DPT3028 and DPT3007 (Figure 3-4). These are intended as sentinel points for horizontal migration, as well as to develop information about lateral effects of treatment.

In March 2015, PCE and TCE were not detected at any of the five sample locations. One or both had been detected in at least one interval of each point during baseline sampling. Cis-1,2-DCE concentrations decreased at all intervals at all locations, except where already low concentrations (<10 µg/L) remained unchanged. Vinyl chloride concentrations have also decreased in most samples from the perimeter; by an order of magnitude at most intervals.

Table 3-1  
Summary of Analytical ResultsBaseline Through Performance Monitoring Events 1 and 2  
Southwest Hot Spot Interim Measure  
GSA Reclamation Yard, Kennedy Space Center

DPT3004		12-13	13-14	14-15	15-16	12.5-16.5		16-17	17-18	18-19	19-20	16.5-20.5	
		12/18/2012	12/18/2012	12/18/2012	12/18/2012	7/24/2014	3/25/2015	12/18/2012	12/18/2012	12/18/2012	12/18/2012	7/24/2014	3/25/2015
PCE	3	7800	2900	4300	4100	7.6 U	7	1100	46000	70000	65000	15 U	8
TCE	3	6100	4600	5400	4400	8.9 U	5	2800	16000	7000	6600	18 U	3
cis-1,2-DCE	70	1900	1500	4100	5700	12	30	8000	5600	2800	2600	210	13
Vinyl Chloride	1	340	230	1000	2900	720	510	6100	690	140	26	1700	800

DPT3004		20-21	21-22	22-23	23-24	23-24	20.5-24.5		24-25	25-26	26-27	24.5-28.5	
		12/18/2012	12/18/2012	12/18/2012	12/18/2012	12/18/2012	7/24/2014	3/25/2015	12/18/2012	12/18/2012	12/18/2012	7/24/2014	3/25/2015
PCE	3	72000	34000	12000	3500	3500	0.76 U	1 U	2700	650	42	0.76 U	1 U
TCE	3	7500	5200	4500	3000	3000	0.89 U	1 U	3200	1600	290	0.89 U	1 U
cis-1,2-DCE	70	2100	920	1100	810	810	0.53 U	1 U	1100	970	290	0.85 I	1 U
Vinyl Chloride	1	22	62	150	120	120	20	38	200	370	120	12	15

DPT3005		11-15		15-19			19-23			23-27			27-31		31-35
		7/24/2014	3/25/2015	12/19/2012	7/24/2014	3/25/2015	12/19/2012	7/24/2014	3/25/2015	12/19/2012	7/24/2014	3/25/2015	12/19/2012	3/26/2015	3/26/2015
PCE	3	2400	3100	170000	10000	1400	150000	16000	12200	2600	96	16000	720	40	35
TCE	3	220	370	2100	5000	240	1300	3800	6000	130	5.4	1200	4.4 U	0.89 U	0.89 U
cis-1,2-DCE	70	2300	1500	1100	16000	260	120	9300	5700	53	24	1200	2.6 U	0.90 I	0.53 U
Vinyl Chloride	1	3000	3200	120	17000	10700	14 U	3200	25500	14 U	270	8800	3.6 U	2.6	1.3

DPT3007		7-11		11-15		15-19		19-23		23-27	
		4/30/2013	3/26/2015	4/30/2013	3/26/2015	4/30/2013	3/26/2015	4/30/2013	3/26/2015	4/30/2013	3/26/2015
PCE	3	30	0.76 U	6	0.76 U	1 U	0.76 U	7	0.76 U	1	0.76 U
TCE	3	1 U	0.89 U	2 U	0.89 U	1 U	0.89 U	1 U	0.89 U	1 U	0.89 U
cis-1,2-DCE	70	1 U	0.53 U	5	0.53 U	6	0.53 U	1 U	0.53 U	1 U	0.53 U
Vinyl Chloride	1	1 U	0.89 I	5	3.5	72	39	1 U	0.71 U	1 U	1.6

DPT3017		11-15		15-19		19-23		23-27	
		5/8/2013	3/24/2015	5/8/2013	3/24/2015	5/8/2013	3/24/2015	5/8/2013	3/24/2015
PCE	3	10 U	3 U	10 U	2 U	1 U	1 U	1 U	1 U
TCE	3	500	3 U	10 U	2 U	1 U	1 U	1 U	1 U
cis-1,2-DCE	70	4000	3 U	1100	2 U	6	1 U	1 U	1 U
Vinyl Chloride	1	1300	280	3100	180	15	18	1 U	1 U

DPT3019		11-15		15-19		19-23		23-27	
		5/8/2013	3/25/2015	5/8/2013	3/25/2015	5/8/2013	3/25/2015	5/8/2013	3/25/2015
PCE	3	2 U	1 U	10 U	3 U	220	3 U	1 U	1 U
TCE	3	2 U	1 U	10 U	3 U	1600	3 U	1 U	1 U
cis-1,2-DCE	70	230	1	1400	400	5000	3 U	2	1 U
Vinyl Chloride	1	220	28	1300	440	1500	200	91	1 U

Table 3-1  
Summary of Analytical ResultsBaseline Through Performance Monitoring Events 1 and 2  
Southwest Hot Spot Interim Measure  
GSA Reclamation Yard, Kennedy Space Center

DPT3021		11-15		15-19		19-23		23-27	
		5/1/2013	3/25/2015	5/1/2013	3/25/2015	5/1/2013	3/25/2015	5/1/2013	3/26/2015
PCE	3	5 U	1 U	3 U	8	14	20 U	1 U	15 U
TCE	3	48	1 U	41	3 U	67	20 U	1 U	18 U
cis-1,2-DCE	70	600	1 U	370	3 U	170	20 U	28	11 U
Vinyl Chloride	1	76	100	150	220	47	6000	57	2300

DPT3022		7-11		11-15		15-19		19-23		23-27	
		5/2/2013	3/25/2015	5/2/2013	3/25/2015	5/2/2013	3/25/2015	5/2/2013	3/25/2015	5/2/2013	3/25/2015
PCE	3	2100	1 U	24800	12	35100	20 U	38600	10 U	23000	43
TCE	3	5000	1 U	4300	19	7600	20 U	6000	10 U	3200	3 U
cis-1,2-DCE	70	750	1 U	1500	98	4200	70	900	10 U	320	3 U
Vinyl Chloride	1	290	2	250	670	840	4300	100 U	1300	50 U	35

DPT3028		7-11		11-15		15-19		19-23		23-27	
		5/9/2013	3/24/2015	5/9/2013	3/24/2015	5/9/2013	3/24/2015	5/9/2013	3/24/2015	5/9/2013	3/24/2015
PCE	3	NS	1 U	56	1 U	41	1 U	1 U	1 U	1 U	1 U
TCE	3	NS	1 U	1100	1 U	190	1 U	1 U	1 U	1 U	1 U
cis-1,2-DCE	70	NS	1 U	1400	17	2700	1 U	1 U	1 U	1 U	1 U
Vinyl Chloride	1	NS	1 U	760	20	2800	4	9	1 U	1 U	1 U

DPT3029		11-15			15-19			19-23			23-27		
		5/9/2013	7/21/2014	3/23/2015	5/3/2013	7/21/2014	3/23/2015	5/9/2013	7/22/2014	3/23/2015	5/9/2013	7/22/2014	3/23/2015
PCE	3	5	0.76 U	1 U	19	670	3 U	890	38 U	10 U	3800	15 U	3 U
TCE	3	3 U	0.89 U	1 U	38	2400 U	3 U	2800	44 U	10 U	4300	18 U	3 U
cis-1,2-DCE	70	690	36	1 U	3600	1900	120	6800	26 U	10 U	3100	11 U	3 U
Vinyl Chloride	1	150	24	31	1100	390	670	830	3600	1100	200	1200	120

DPT3031		11-15			15-19			19-23			23-27		
		5/10/2013	7/24/2014	3/23/2015	5/10/2013	7/24/2014	3/23/2015	5/10/2013	7/24/2014	3/23/2015	5/10/2013	7/24/2014	3/23/2015
PCE	3	10 U	0.76 U	1 U	15900	76 U	22	33800	35	7	34	1.3	1 U
TCE	3	280	0.89 U	1 U	7600	89 U	16	11200	68	3	330	1.1	1 U
cis-1,2-DCE	70	3900	0.53 U	1 U	6200	290	66	3400	230	30	310	3.1	1 U
Vinyl Chloride	1	1800	5.2	9	900	6300	980	310	930	77	180	67	55

Table 3-1  
Summary of Analytical ResultsBaseline Through Performance Monitoring Events 1 and 2  
Southwest Hot Spot Interim Measure  
GSA Reclamation Yard, Kennedy Space Center

DPT3032		7-11		11-15		15-19		19-23		23-27		27-31	
		5/13/2013	3/24/2015	5/13/2013	3/24/2015	5/13/2013	3/24/2015	5/13/2013	3/24/2015	5/13/2013	3/24/2015	5/13/2013	3/24/2015
PCE	3	NS	1 U	1300	1 U	25600	3 U	9200	3 U	1000	1 U	NS	1 U
TCE	3	NS	1 U	4400	1 U	12600	3 U	15500	3 U	3000	1 U	NS	1 U
cis-1,2-DCE	70	NS	1 U	3000	1 U	4500	3 U	3500	3 U	2700	1 U	NS	1 U
Vinyl Chloride	1	NS	1 U	820	79	570	370	200	220	730	1 U	NS	1 U

DPT3033		7-11		11-15		15-19		19-23		23-27		27-31	
		5/13/2013	3/26/2015	5/13/2013	3/26/2015	5/13/2013	3/26/2015	5/13/2013	3/26/2015	5/13/2013	3/26/2015	5/13/2013	3/26/2015
PCE	3	1 U	2.6	3000	760	1 U	9.5	1 U	2.2	1 U	0.76 U	1 U	NS
TCE	3	1 U	0.89 U	620	200	1 U	1.8	1 U	0.89 U	1 U	0.89 U	1 U	NS
cis-1,2-DCE	70	1 U	0.53 U	400	310	1 U	6.7	1 U	4.7	1 U	3.3	1 U	NS
Vinyl Chloride	1	1	1.6	40 U	590	3	160	1 U	8.1	1 U	9.9	1 U	NS

DPT3034		11-15		15-19		19-23		23-27	
		5/14/2013	3/24/2015	5/14/2013	3/24/2015	5/14/2013	3/24/2015	5/14/2013	3/24/2015
PCE	3	3 U	1 U	10 U	3 U	120	5 U	10 U	3 U
TCE	3	3 U	1 U	10 U	3 U	3400	5 U	650	3 U
cis-1,2-DCE	70	360	2	790	3 U	3900	5 U	2000	3 U
Vinyl Chloride	1	400	33	1200	330	840	450	740	210

DPT3035		11-15			15-19			19-23			23-27		
		5/14/2013	7/23/2014	3/23/2015	5/14/2013	7/23/2014	3/23/2015	5/14/2013	7/23/2014	3/23/2015	5/14/2013	7/23/2014	3/23/2015
PCE	3	10 U	1.9 U	1 U	5800	76 U	14	16000	3.8 U	3 U	2	0.76 U	1 U
TCE	3	10 U	2.2 U	1 U	2400	89 U	10 U	11000	4.4 U	3 U	1 U	0.89 U	1 U
cis-1,2-DCE	70	1500	1.3 U	1 U	3500	180	10 U	3800	10	3 U	1 U	9.0	1
Vinyl Chloride	1	1100	180	62	3000	4500	2000	550	250	290	1 U	32	12

Key:  
U: The compound was analyzed for but not detected  
I: The reported value is between the laboratory method detection limit and method reporting limit  
Bold typeface indicates that the analyte was detected



SCRAP  
METAL  
STORAGE  
AREA

DPT3019	11-15	15-19	19-23	23-27
PCE	3	2	1	1
TCE	3	2	1	1
cis-1,2-DCE	70	230	1	1
trans-1,2-DCE	100	2	1	1
1,1-DCE	7	4	1	1
Vinyl Chloride	1	220	28	1300

DPT3034	11-15	15-19	19-23	23-27
PCE	3	3	1	1
TCE	3	3	1	1
cis-1,2-DCE	70	360	2	790
trans-1,2-DCE	100	3	1	10
1,1-DCE	7	5	1	32
Vinyl Chloride	1	400	33	1200

DPT3029	11-15	15-19	19-23	23-27
PCE	3	5	1	1
TCE	3	3	1	1
cis-1,2-DCE	70	690	36	1
trans-1,2-DCE	100	17	0.73	1
1,1-DCE	7	13	0.94	1
Vinyl Chloride	1	150	24	31

DPT3004	12-13	13-14	14-15	15-16	12.5-16.5	16-17	17-18	18-19	19-20	16.5-20.5
PCE	3	7800	2900	4300	4100	7.6	7.6	7.6	15	8
TCE	3	6100	4600	5400	4400	8.9	8.9	8.9	18	3
cis-1,2-DCE	70	1900	1500	4100	5700	12	30	8000	2600	210
trans-1,2-DCE	100	70	83	130	100	7.3	5	180	170	49
1,1-DCE	7	31	23	68	150	9.4	3	150	65	23
Vinyl Chloride	1	340	230	1000	2900	720	510	6100	140	26

DPT3004	20-21	21-22	22-23	23-24	23-24	20.5-24.5	24-25	25-26	26-27	24.5-28.5
PCE	3	72000	34000	12000	3600	0.76	1	2700	660	42
TCE	3	7500	5200	4500	3000	0.89	1	3200	1600	290
cis-1,2-DCE	70	2100	920	1100	810	0.53	1	1100	970	0.85
trans-1,2-DCE	100	130	49	38	34	0.73	1	57	17	0.73
1,1-DCE	7	16	43	47	57	0.94	1	65	54	13
Vinyl Chloride	1	22	62	150	120	20	38	200	370	12

DPT3021	11-15	15-19	19-23	23-27
PCE	3	5	1	1
TCE	3	48	1	1
cis-1,2-DCE	70	600	1	370
trans-1,2-DCE	100	60	1	43
1,1-DCE	7	5	1	4
Vinyl Chloride	1	76	100	150

DPT3022	7-11	11-15	15-19	19-23	23-27
PCE	3	2100	1	24800	12
TCE	3	6000	1	4300	19
cis-1,2-DCE	70	750	1	1500	98
trans-1,2-DCE	100	7	1	100	10
1,1-DCE	7	13	1	100	10
Vinyl Chloride	1	290	2	250	670

DPT3005	11-15	15-19	19-23	23-27	27-31	31-35
PCE	3	2400	3100	170000	10000	12200
TCE	3	220	370	2100	5000	240
cis-1,2-DCE	70	2300	1500	1100	16000	260
trans-1,2-DCE	100	73	20	180	37	180
1,1-DCE	7	94	20	19	240	20
Vinyl Chloride	1	3000	3200	120	17000	10700

DPT3007	7-11	11-15	15-19	19-23	23-27
PCE	3	30	0.76	6	0.76
TCE	3	1	0.89	2	0.89
cis-1,2-DCE	70	1	0.53	6	0.53
trans-1,2-DCE	100	1	0.73	2	0.73
1,1-DCE	7	1	0.94	2	0.94
Vinyl Chloride	1	1	0.89	5	3.5

DPT3035	11-15	15-19	19-23	23-27
PCE	3	10	1	1
TCE	3	10	1	1
cis-1,2-DCE	70	1500	1	1
trans-1,2-DCE	100	10	1	1
1,1-DCE	7	46	1	1
Vinyl Chloride	1	1100	180	62

DPT3017	11-15	15-19	19-23	23-27
PCE	3	10	1	1
TCE	3	10	1	1
cis-1,2-DCE	70	4000	3	1100
trans-1,2-DCE	100	190	6	10
1,1-DCE	7	110	3	25
Vinyl Chloride	1	1300	280	3100

DPT3031	11-15	15-19	19-23	23-27
PCE	3	10	1	1
TCE	3	280	0.89	1
cis-1,2-DCE	70	3900	0.53	1
trans-1,2-DCE	100	94	0.73	1
1,1-DCE	7	100	0.94	1
Vinyl Chloride	1	1800	5.2	9

DPT3032	7-11	11-15	15-19	19-23	23-27	27-31
PCE	3	NS	1	1300	1	25600
TCE	3	NS	1	4400	1	12500
cis-1,2-DCE	70	NS	1	3000	1	4500
trans-1,2-DCE	100	NS	1	77	1	78
1,1-DCE	7	NS	1	83	1	50
Vinyl Chloride	1	NS	1	820	79	570

DPT3028	7-11	11-15	15-19	19-23	23-27
PCE	3	NS	1	1	1
TCE	3	NS	1	1100	1
cis-1,2-DCE	70	NS	1	1400	1
trans-1,2-DCE	100	NS	1	100	1
1,1-DCE	7	NS	1	30	1
Vinyl Chloride	1	NS	1	760	20

DPT3033	7-11	11-15	15-19	19-23	23-27	27-31
PCE	3	1	2.6	3000	760	1
TCE	3	1	0.89	620	200	1
cis-1,2-DCE	70	1	0.53	400	310	1
trans-1,2-DCE	100	1	0.73	40	15	1
1,1-DCE	7	1	0.94	40	19	1
Vinyl Chloride	1	1	1.6	40	590	3

Legend:

PCE Concentration in ug/L (Baseline)

300 ug/L

10,000 ug/L  
Isoleths are inferred.

Historical DPT Groundwater Sampling Location

DPT Groundwater Sampling Location

Monitoring Wells Abandoned During the IM

DPT Soil Sampling Location

Proposed DPT Sample Location

Existing Chain Link Fence

Facility/Structure

Notes:

- Yellow and White coloring used to distinguish between sampling intervals
- Green coloring used to highlight groundwater cleanup target levels (GCTLs) for each analyte
- Concentrations above GCTLs are bold
- Concentrations above NADCLs are Bold and the cell is outlined

U: The compound was analyzed for but not detected

NS: Not Sampled

I: The reported value is between the laboratory method detection limit and method reporting limit

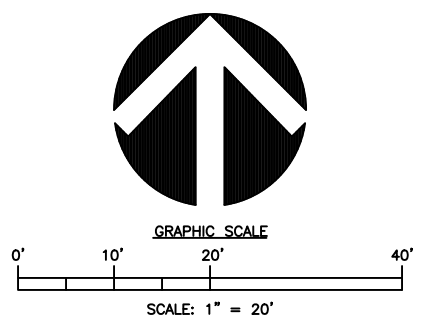
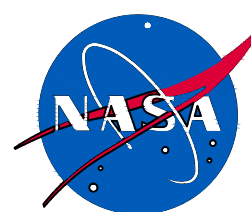


Figure 3-2

PN: 35DK3802  
Prepared By: R.Sardo  
Date: 06/24/2015  
Ref: DPTMonitoring.dwg



NATIONAL AERONAUTICS AND  
SPACE ADMINISTRATION

GSA Reclamation Yard  
Southwest Hot Spot Interim Measure  
Performance Monitoring Results, 2012- 2015



DPT3031		11-15					15-19					19-23					23-27								
		5/10/2013		7/24/2014		3/23/2015	5/10/2013		7/24/2014		3/23/2015	5/10/2013		7/24/2014		3/23/2015	5/10/2013		7/24/2014		3/23/2015				
PCE	3	10	U	0.76	U	1	U	15900		76	U	22		33800		35		7		34		1.3		1	U
TCE	3	280		0.89	U	1	U	7600		89	U	16		11200		68		3		330		1.1		1	U
cis-1,2-DCE	70	3900		0.53	U	1	U	6200		290		66		3400		230		30		310		3.1		1	U
Vinyl Chloride	1	1800		5.2			9	900		6300		980		310		930		77		180		67			55

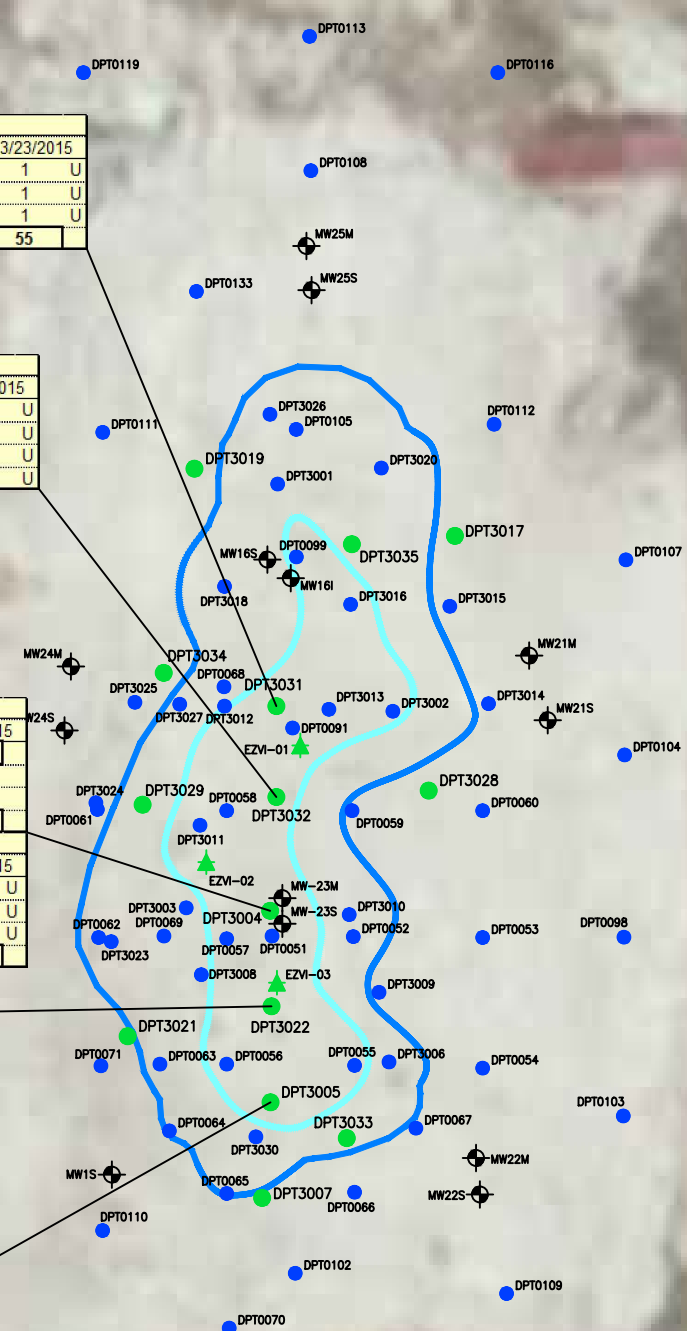
DPT3032		7-11		11-15		15-19		19-23		23-27		27-31	
		5/13/2013	3/24/2015	5/13/2013	3/24/2015	5/13/2013	3/24/2015	5/13/2013	3/24/2015	5/13/2013	3/24/2015	5/13/2013	3/24/2015
PCE	3	NS	1	U	1300	1	U	25600	3	U	9200	3	U
TCE	3	NS	1	U	4400	1	U	12600	3	U	15500	3	U
cis-1,2-DCE	70	NS	1	U	3000	1	U	4500	3	U	3500	3	U
Vinyl Chloride	1	NS	1	U	820	79	570	370	200	220	730	1	U

DPT3004		12-13	13-14	14-15	15-16	12.5-16.5		16-17	17-18	18-19	19-20	16.5-20.5			
		12/18/2012	12/18/2012	12/18/2012	12/18/2012	7/24/2014	3/25/2015	12/18/2012	12/18/2012	12/18/2012	12/18/2012	7/24/2014	3/25/2015		
PCE	3	7800	2900	4300	4100	7.6	U	7	1100	46000	70000	65000	15	U	8
TCE	3	6100	4600	5400	4400	8.9	U	5	2800	16000	7000	6600	18	U	3
cis-1,2-DCE	70	1900	1500	4100	5700	12		30	8000	5600	2800	2600	210		13
Vinyl Chloride	1	340	230	1000	2900	720		510	6100	690	140	26	1700		800

DPT3004		20-21	21-22	22-23	23-24	23-24	20.5-24.5		24-25	25-26	26-27	24.5-28.5					
		12/18/2012	12/18/2012	12/18/2012	12/18/2012	12/18/2012	7/24/2014	3/25/2015	12/18/2012	12/18/2012	12/18/2012	7/24/2014	3/25/2015				
PCE	3	72000	34000	12000	3500	3500	0.76	U	1	U	2700	650	42	0.76	U	1	U
TCE	3	7500	5200	4500	3000	3000	0.89	U	1	U	3200	1600	290	0.89	U	1	U
cis-1,2-DCE	70	2100	920	1100	810	810	0.53	U	1	U	1100	970	290	0.85		1	U
Vinyl Chloride	1	22	62	150	120	120	20		38		200	370	120	12		15	

DPT3022		7-11		11-15		15-19		19-23		23-27	
		5/2/2013	3/25/2015	5/2/2013	3/25/2015	5/2/2013	3/25/2015	5/2/2013	3/25/2015	5/2/2013	3/25/2015
PCE	3	2100	1	U	24800	12	35100	20	U	38600	10
TCE	3	5000	1	U	4300	19	7600	20	U	6000	10
cis-1,2-DCE	70	750	1	U	1500	98	4200	70	900	10	3200
Vinyl Chloride	1	290	2	250	670	840	4300	100	U	1300	50

DPT3005		11-15		15-19		19-23		23-27		27-31		31-35
		7/24/2014	3/25/2015	12/19/2012	7/24/2014	3/25/2015	12/19/2012	7/24/2014	3/25/2015	12/19/2012	3/26/2015	3/26/2015
PCE	3	2400	3100	170000	10000	1400	150000	16000	12200	2600	96	16000
TCE	3	220	370	2100	5000	240	1300	3800	6000	130	5.4	1200
cis-1,2-DCE	70	2300	1500	1100	16000	260	120	9300	5700	53	24	1200
Vinyl Chloride	1	3000	3200	120	17000	10700	14	U	3200	25500	14	U



#### Legend:

PCE Concentration in ug/L

300 ug/L

10,000 ug/L

Isopleths are inferred.

xxxx Historical DPT Groundwater Sampling Location

xxxx Groundwater Sampling Location

xx Monitoring Wells Abandoned During the IM

▲ DPT Soil Sampling Location

Existing Chain Link Fence

Facility/Structure

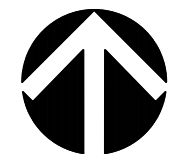
#### Notes:

- Yellow and White coloring used to distinguish between sampling intervals
- Green coloring used to highlight groundwater cleanup target levels (GCTLs) for each analyte
- Concentrations above GCTLs are bold
- Concentrations above NADCs are Bold and the cell is outlined

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NS: Not Sampled

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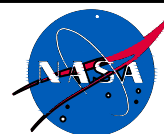
GRAPHIC SCALE

0' 30' 60'

SCALE: 1" = 30'

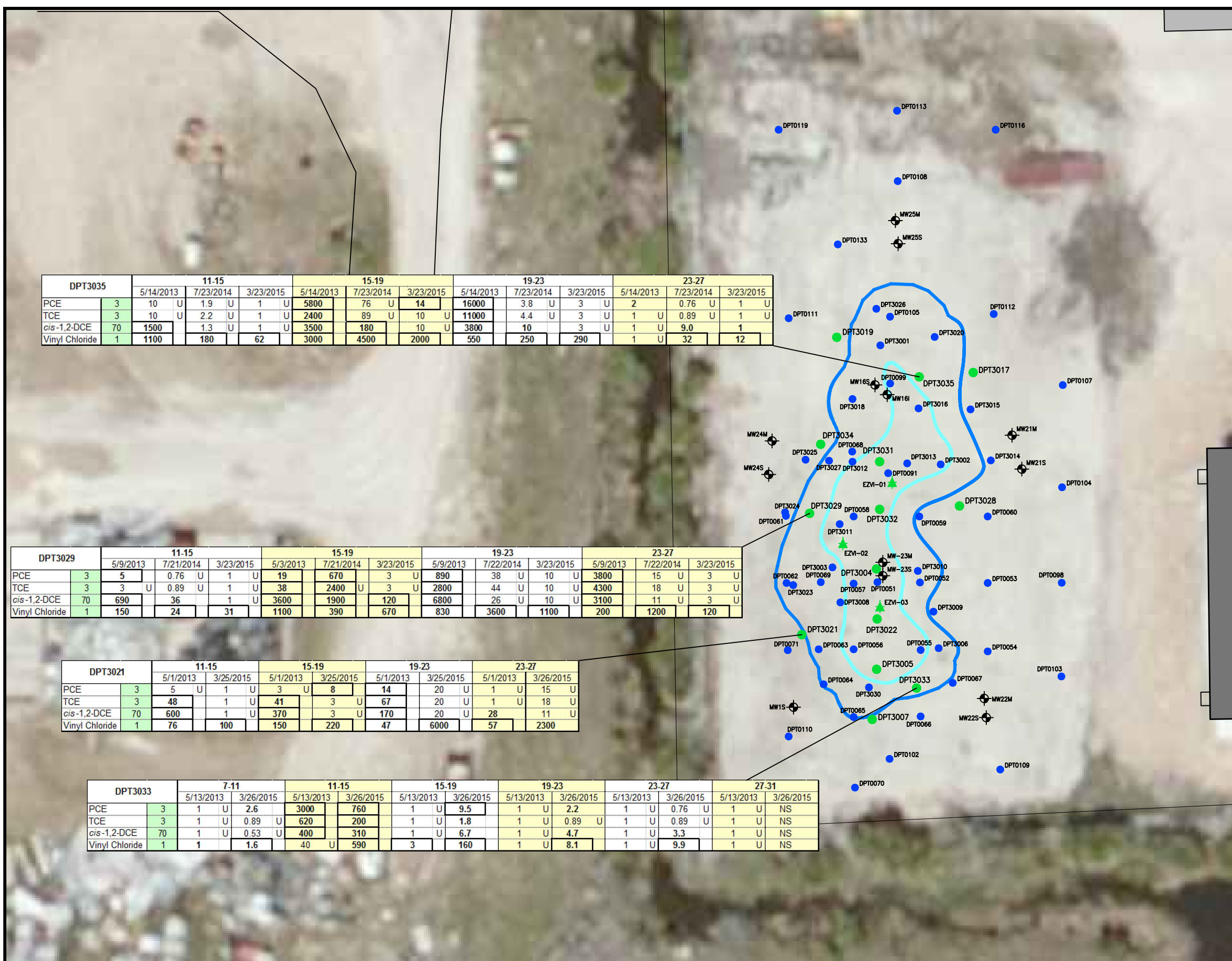
Figure 3-2

PN: 35DK3802  
Prepared By: R.Ashton  
Date: 10/24/13  
Ref: DPTMonitoring.dwg



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GSA Reclamation Yard  
Southwest Hot Spot Interim Measure  
Performance Monitoring Results, EZVI Treatment Area



Legend:

PCE Concentration in ug/L

300 ug/L

10,000 ug/L

Isopleths are inferred.

xxxx Historical DPT Groundwater Sampling Location

xxxx Groundwater Sampling Location

xx Monitoring Wells Abandoned During the IM

▲ DPT Soil Sampling Location

Existing Chain Link Fence

Facility/Structure

Notes:

- Yellow and White coloring used to distinguish between sampling intervals
- Green coloring used to highlight groundwater cleanup target levels (GCTLs) for each analyte
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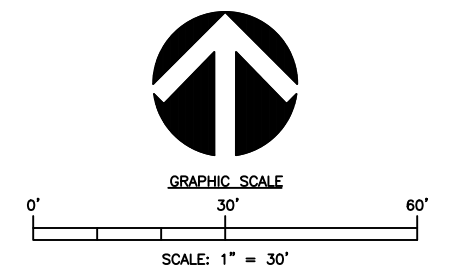
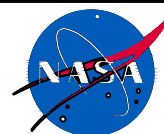


Figure 3-3

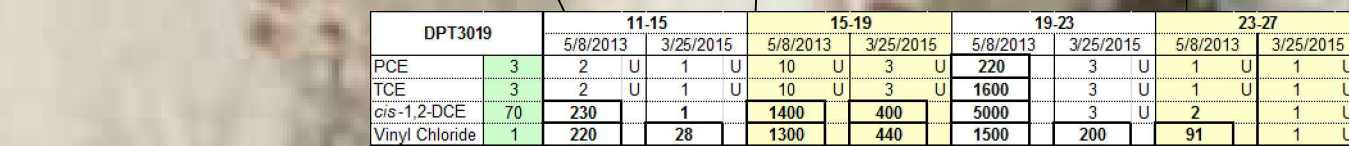
PN: 35DK3802  
Prepared By: R.Ashton  
Date: 10/24/13  
Ref: DPTMonitoring.dwg



NATIONAL AERONAUTICS AND  
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GSA Reclamation Yard  
Southwest Hot Spot Interim Measure  
Performance Monitoring Results, VO/L Treatment Area



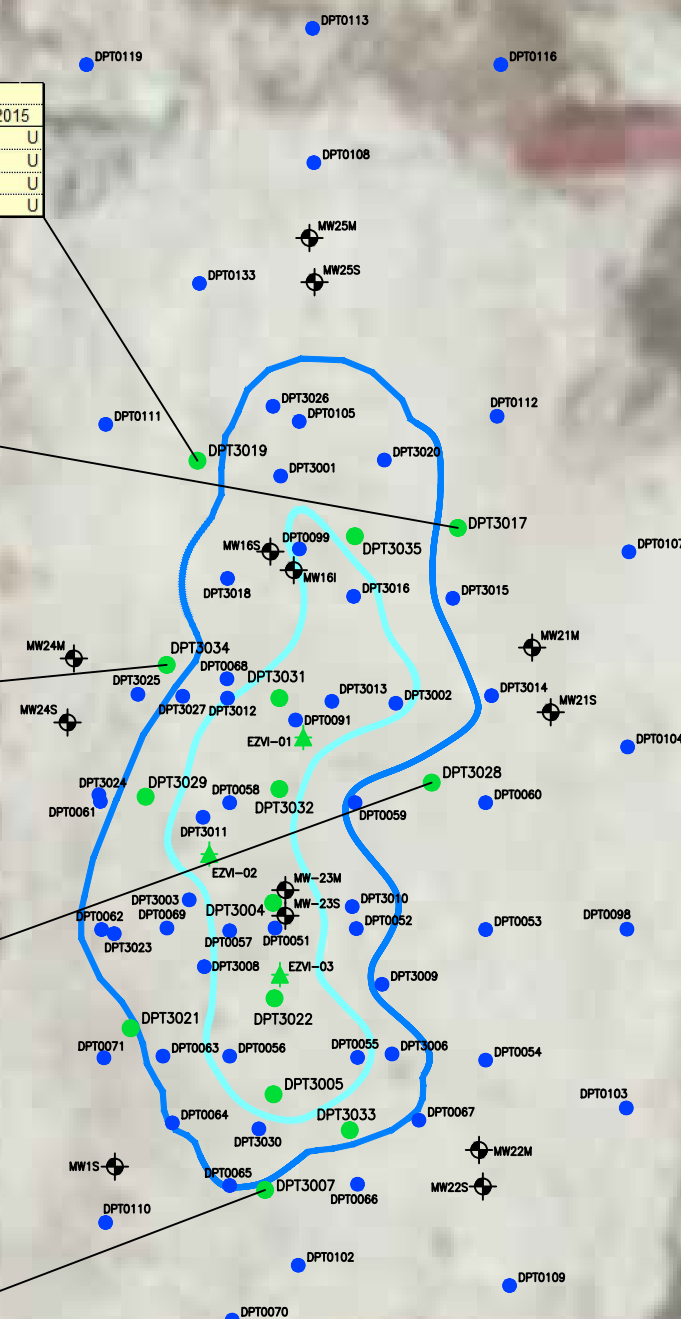


DPT3017		11-15			15-19			19-23			23-27						
		5/8/2013	3/24/2015		5/8/2013	3/24/2015		5/8/2013	3/24/2015		5/8/2013	3/24/2015					
PCE	3	10	U	3	U	10	U	2	U	1	U	1	U	1	U	1	U
TCE	3	500		3	U	10	U	2	U	1	U	1	U	1	U	1	U
cis-1,2-DCE	70	4000		3	U	1100		2	U	6		1	U	1	U	1	U
Vinyl Chloride	1	1300		280		3100		180		15		18		1	U	1	U

DPT3034		11-15			15-19			19-23			23-27						
		5/14/2013	3/24/2015		5/14/2013	3/24/2015		5/14/2013	3/24/2015		5/14/2013	3/24/2015					
PCE	3	3	U	1	U	10	U	3	U	120		5	U	10	U	3	U
TCE	3	3	U	1	U	10	U	3	U	3400		5	U	650		3	U
cis-1,2-DCE	70	360		2		790		3	U	3900		5	U	2000		3	U
Vinyl Chloride	1	400		33		1200		330		840		450		740		210	

DPT3028		7-11			11-15			15-19			19-23			23-27				
		5/9/2013	3/24/2015		5/9/2013	3/24/2015		5/9/2013	3/24/2015		5/9/2013	3/24/2015		5/9/2013	3/24/2015			
PCE	3	NS	1	U	56	1	U	41	1	U	1	U	1	U	1	U	1	U
TCE	3	NS	1	U	1100	1	U	190	1	U	1	U	1	U	1	U	1	U
cis-1,2-DCE	70	NS	1	U	1400	17		2700	1	U	1	U	1	U	1	U	1	U
Vinyl Chloride	1	NS	1	U	760	20		2800	4		9		1	U	1	U	1	U

DPT3007		7-11			11-15			15-19			19-23			23-27		
		4/30/2013	3/26/2015		4/30/2013	3/26/2015		4/30/2013	3/26/2015		4/30/2013	3/26/2015		4/30/2013	3/26/2015	
PCE	3	30		0.76 U	6		0.76 U	1	U	0.76 U	7		0.76 U	1	U	0.76 U
TCE	3	1	U	0.89 U	2	U	0.89 U	1	U	0.89 U	1	U	0.89 U	1	U	0.89 U
cis-1,2-DCE	70	1	U	0.53 U	5		0.53 U	6		0.53 U	1	U	0.53 U	1	U	0.53 U
Vinyl Chloride	1	1	U	0.89 U	5		3.5 U	72		39 U	1	U	0.71 U	1	U	1.6 U



Legend:

PCE Concentration in ug/L

300 ug/L

10,000 ug/L

Isopleths are inferred.

●<sup>XXXX</sup> Historical DPT Groundwater Sampling Location

●<sup>XXXX</sup> Groundwater Sampling Location



## Monitoring Wells Abandoned During the IM

 DPT Soil Sampling Location

———— Existing Chain Link Fence

Facility/Structure

Notes:

- Yellow and White coloring used to distinguish between sampling intervals
- Green coloring used to highlight groundwater cleanup target levels (GCTLs) for each analyte
- Concentrations above GCTLs are bold
- Concentrations above NADCs are Bold and the cell is outlined

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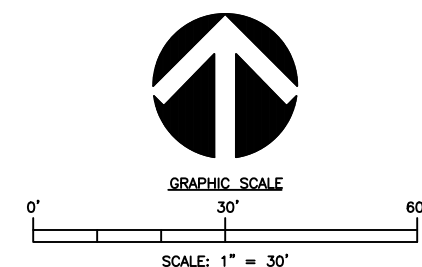


Figure 3-4

## **Section 4**

### **UIC SAMPLING AND RESULTS**

#### **4.1 UIC SAMPLING EVENTS**

Baseline UIC sampling was completed on November 15, 2012, which consisted of collecting samples for iron (Method 6010), TRPH (Method FL-PRO), and TDS (Method 2540) from three monitoring wells (GSRY-MW0021M, GSRY-MW0022M, and GSRY-MW0023M) located within, or around the anticipated zone of discharge (Figure 4-1). A fourth monitoring well was also scoped to be sampled (MW0025M); however, this well was found to be damaged and could not be sampled. The UIC parameters that were collected were based on monitoring requirements associated with the injected substrate: iron for EZVI; and TRPH and TDS for VO/L.

To support the injection activities, the three monitoring wells used to collect baseline UIC parameters were abandoned. Therefore, during Event 1 (July 2014) and Event 2 (March 2015), UIC parameters were collected using DPT to obtain a sample at the location and similar depth as the former wells (Figure 4-1). Since the three abandoned wells were screened from 16-21 ft. bgs, the groundwater samples were collected from 16.5-20.5 ft. bgs using a 4-foot long screen point sampler. Following data collection, each DPT location was grouted to surface, from bottom to top, using a tremie pipe. The samples were analyzed for iron (Method 6010), TRPH (Method FL-PRO) and TDS (Method 2540).

#### **4.2 UIC RESULTS SUMMARY**

UIC parameter results from the three sampling events are summarized on Table 4-1 and Figure 4-1. The results from the two performance monitoring events exceeded applicable screening criteria (FDEP GCTL criteria for TRPH, or below baseline sampling results or KSC Upper Range of Background for iron and TDS), which indicate that groundwater plume conditions have not reached pre-injection conditions. Due to the injection of EZVI, the elevated results for iron are expected. TDS levels may be high in part due to the injection activities, which disturbed the soil matrix and loosened sediments. Also, the fact that the performance monitoring samples were collected using DPT rather than from monitoring wells may contribute to the elevated TDS, as that sampling method does not employ a filter pack to reduce solids.

**Table 4-1**  
**Summary of UIC Results**  
**Southwest Hot Spot Interim Measure**  
**GSA Reclamation Yard, Kennedy Space Center**

<i>Sample Location:</i>		GSRY-MW0021M			GSRY-MW0022M			GSRY-MW0023M		
<i>Screened Interval (ft. bgs):</i>		16-21	16.5-20.5	16.5-20.5	16-21	16.5-20.5	16.5-20.5	16-21	16.5-20.5	16.5-20.5
<i>Sample Date:</i>		11/15/2012	7/21/2014	3/26/2015	11/15/2012	7/21/2014	3/26/2015	11/15/2012	7/24/2014	3/25/2015
	<b>Screening Value</b>									
Iron (ug/L)	2700	<b>1210</b>	<b>22900</b>	<b>21500</b>	<b>1220</b>	<b>17700</b>	<b>12200</b>	<b>811</b>	<b>20600</b>	<b>39800</b>
TRPH (mg/L)	50	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	<b>0.13</b> I	<b>3</b>	0.10 U	<b>31</b>
TDS (mg/L)	980	<b>950</b>	<b>930</b>	<b>1100</b>	<b>920</b>	<b>920</b>	<b>930</b>	<b>980</b>	<b>2200</b>	<b>3600</b>

Note: Baseline samples (2012) collected from monitoring wells that were abandoned prior to treatment. 2014-2015 samples collected at same locations and interval using direct push technology.

**Key:**

U: The compound was analyzed for but not detected

I: The reported value is between the laboratory method detection limit and method reporting limit

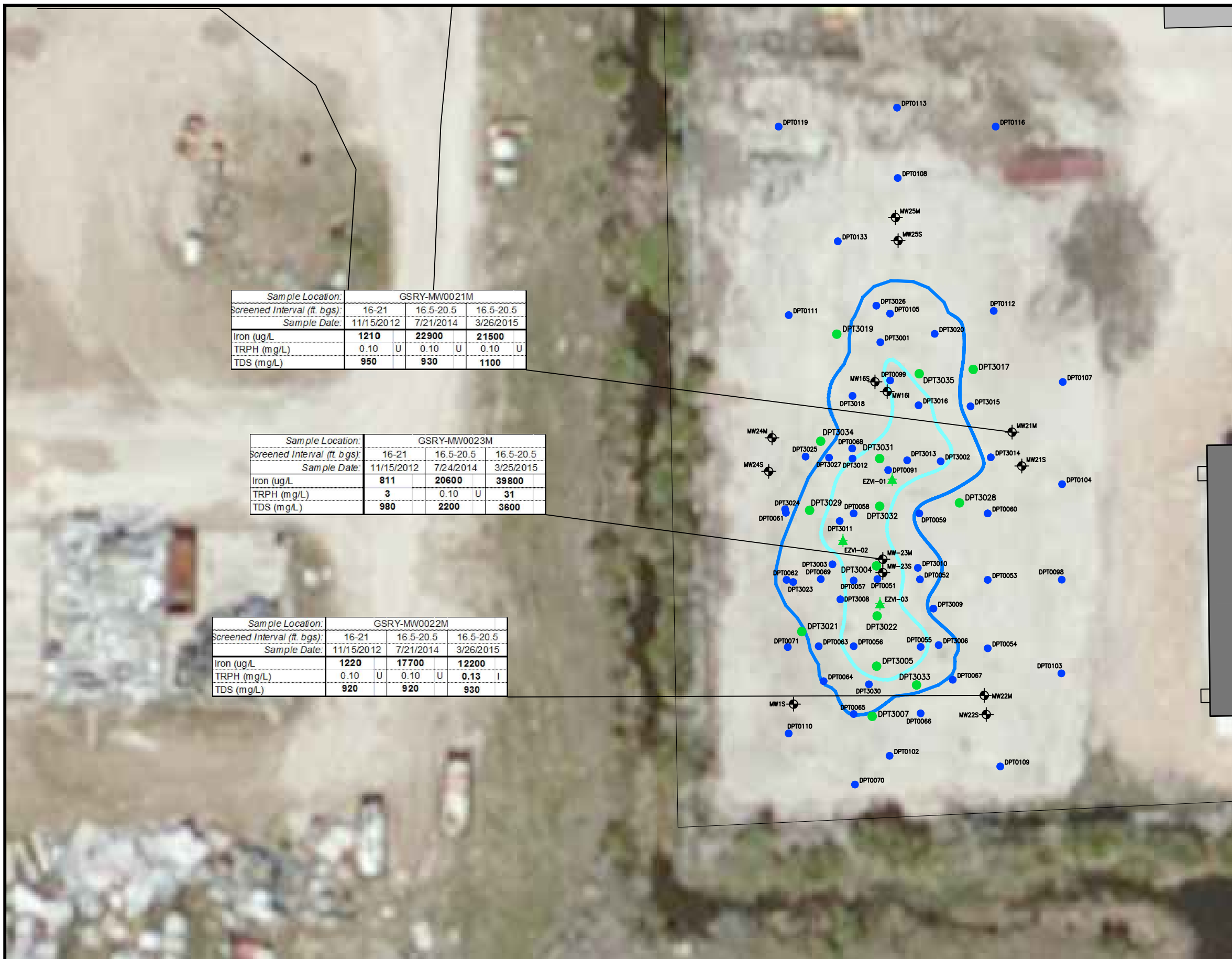
**Bold typeface** indicates that the analyte was detected

**Note:** Iron screening standard – KSC Upper Range of Background for Class G2 Groundwater

TRPH screening standard – State of Florida Groundwater Cleanup Target Level

TDS screening standard – Maximum Baseline Concentration

I:\NASA\35DK3802\CADD\FIGURES\DPTMONITORING.DWG  
TAB: Figure\_4-1



**Legend:**

PCE Concentration in ug/L

300 ug/L

10,000 ug/L

Isopleths are inferred.

xxxx Historical DPT Groundwater Sampling Location

xxxx Groundwater Sampling Location

xx Monitoring Wells Abandoned During the IM

▲ DPT Soil Sampling Location

Existing Chain Link Fence

Facility/Structure

**Notes:**

• Bold indicates that analyte was detected

U: The compound was analyzed for but not detected

I: The reported value is between the laboratory method detection limit and method reporting limit

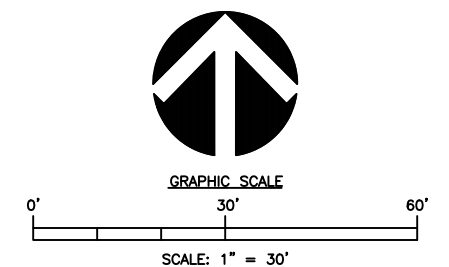
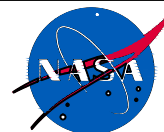


Figure 4-1

PN:	35DK3802
Prepared By:	R.Ashton
Date:	10/24/13
Ref:	DPTMonitoring.dwg



NATIONAL AERONAUTICS AND  
SPACE ADMINISTRATION

GSA Reclamation Yard  
Southwest Hot Spot Interim Measure  
UIC Monitoring Results

## Section 5 CONCLUSIONS AND RECOMMENDATIONS

### 5.1 CONCLUSIONS

#### 5.1.1 Contaminant Reduction

The EZVI and VO/L IM injections at the Southwest Hot Spot at GSRY have resulted in significant contaminant reductions across the treatment area. In order to quantify the reduction, three approaches were used: (1) comparison of the molar concentrations of the target compound at baseline and in March 2015; (2) comparison of the PCE plume volumes at baseline and in March 2015; and (3) through visualization of the hot spot at baseline and in March 2015.

##### Molar Concentrations

The analytical results for the baseline and performance monitoring events were converted to molar concentrations (Appendix D). For the five points within the EZVI treatment areas, the pre-treatment molar concentration was 5,151  $\mu\text{mol/L}$ . Results from the March 2015 sampling event yielded 1,184  $\mu\text{mol/L}$ ; a reduction of 77%. Within the VO/L treatment area, molar concentrations went from 710  $\mu\text{mol/L}$  at baseline to 230  $\mu\text{mol/L}$  in March 2015; a reduction of 68%.

##### PCE Plume Volume

As a second tool, the volume of the PCE plume above its NADC was compared between the baseline sampling event and the second performance monitoring event. The volume of the plume exceeding 10,000  $\mu\text{g/L}$  (PCE concentration) has reduced by 93%. The volume of the plume exceeding 300  $\mu\text{g/L}$  for PCE has reduced by 88%. Figure 5-1 presents the 10,000 and 300  $\mu\text{g/L}$  PCE volumes graphically in plan and profile views.

##### Hot Spot Visualization

Finally, environmental visualization software (EVS) simulations were prepared for comparison of baseline PCE results to Event 2 data (March 2015). Figure 5-2a illustrates baseline and the post-treatment isopleths using all baseline sample locations. Because not all baseline sampling locations are used in performance monitoring, data from the baseline sampling event is retained in that figure. For that reason, Figure 5-2b was developed to carry forward only those points used in performance monitoring in the post-treatment visualization. Both evaluations show no areas exceeding 30,000  $\mu\text{g/L}$  PCE concentrations by March 2015. Where historical data is carried forward (Figure 5-2a), some areas exceeding 10,000  $\mu\text{g/L}$  appear on the south end of the hot spot, though greatly reduced. When the visualization includes only points with both pre- and post-treatment results (Figure 5-2b), the 10,000  $\mu\text{g/L}$  contour is almost eliminated and the area exceeding 300  $\mu\text{g/L}$  is significantly decreased in size.

### **5.1.2 Breakdown Product Concentrations**

When biostimulation is a part of a remedy, increasing concentrations of breakdown products (TCE, 1,2-DCE and vinyl chloride) need to be evaluated for their role in the overall treatment process/effectiveness. Based on molar concentrations, TCE and cis-1,2-DCE have decreased by 95% and 94%, respectively, since baseline. Vinyl chloride, however, has increased 220% on a molar concentration basis. To further assess the potential spread of vinyl chloride, baseline and Event 2 vinyl chloride profiles were generated for comparison (Figure 5-3). The figure shows the vinyl chloride footprint expanding on the south side of the hot spot (south of DPT3005, but not as far as DPT3007). The thickness of vinyl chloride above its NADC also increased on the south, but decreased to the north. The concentration of vinyl chloride rose above the highest baseline levels at DPT3005, which is consistent with biodegradation.

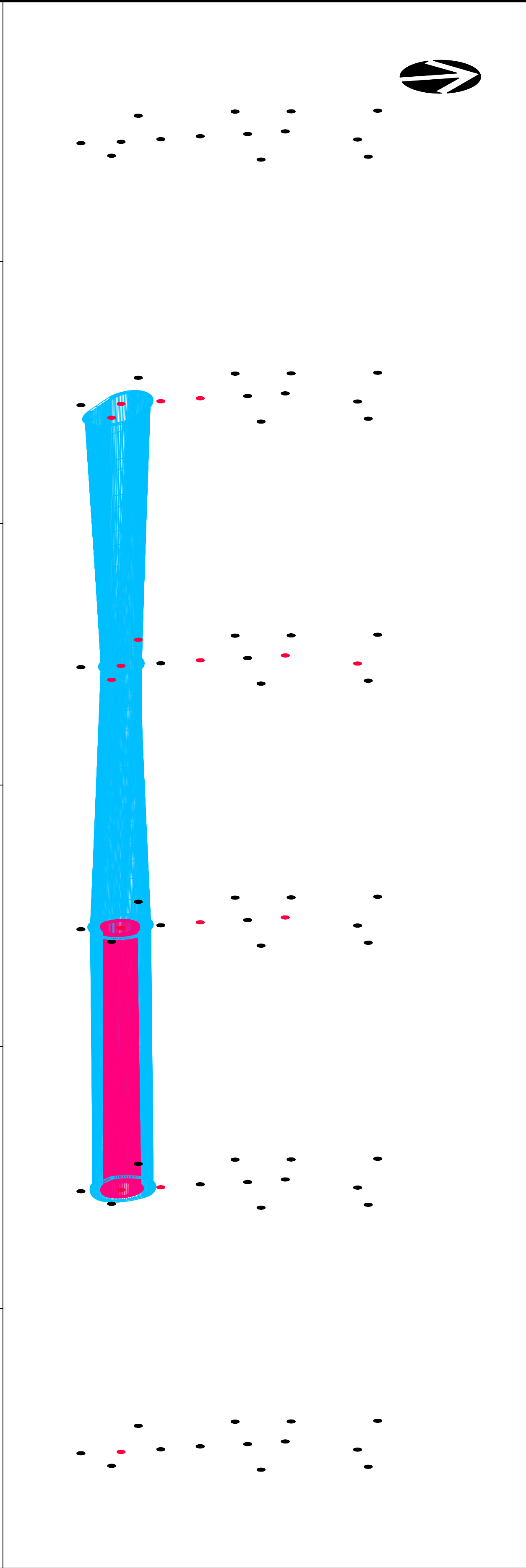
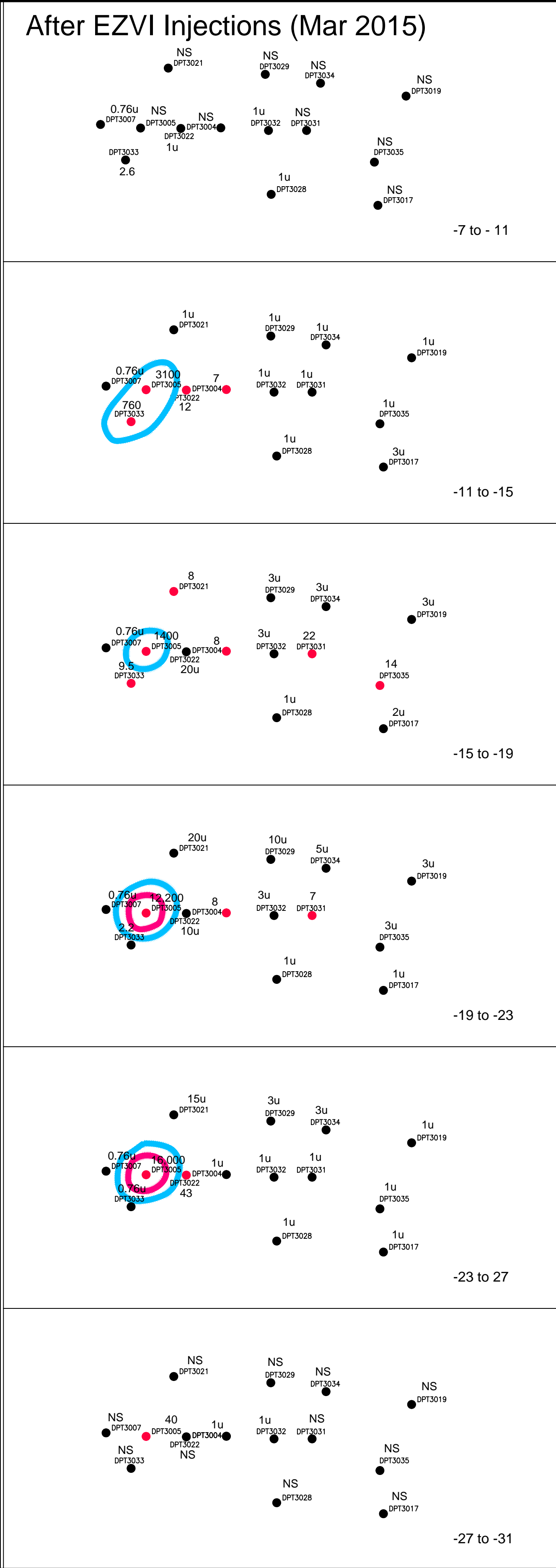
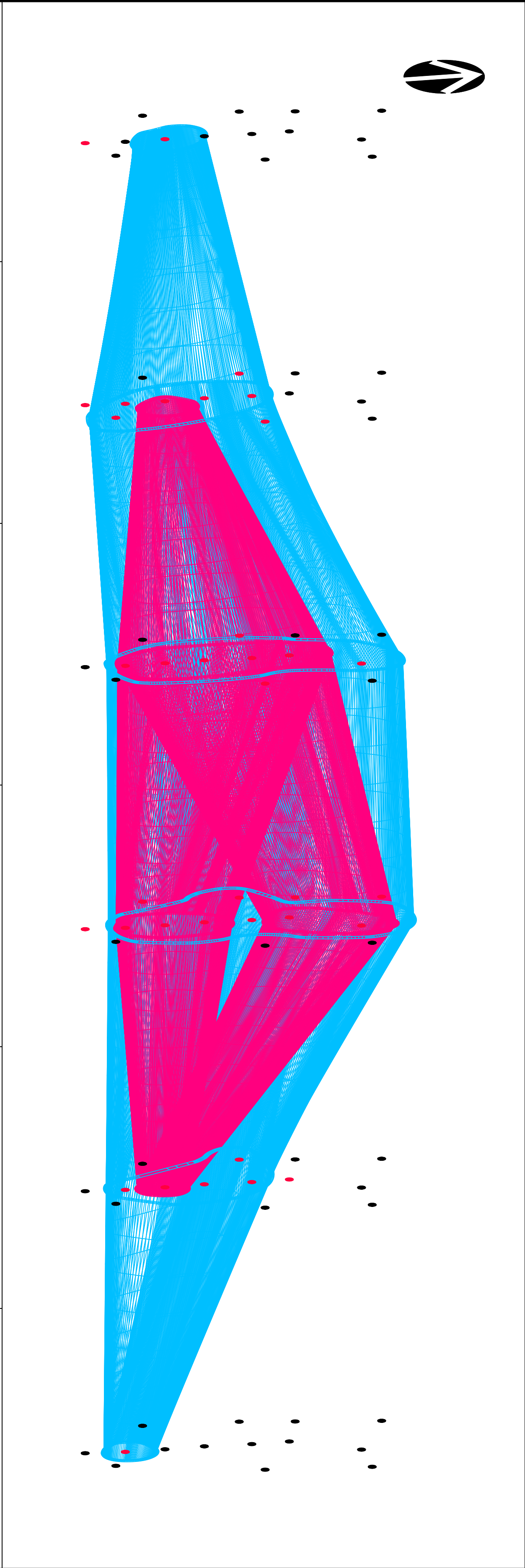
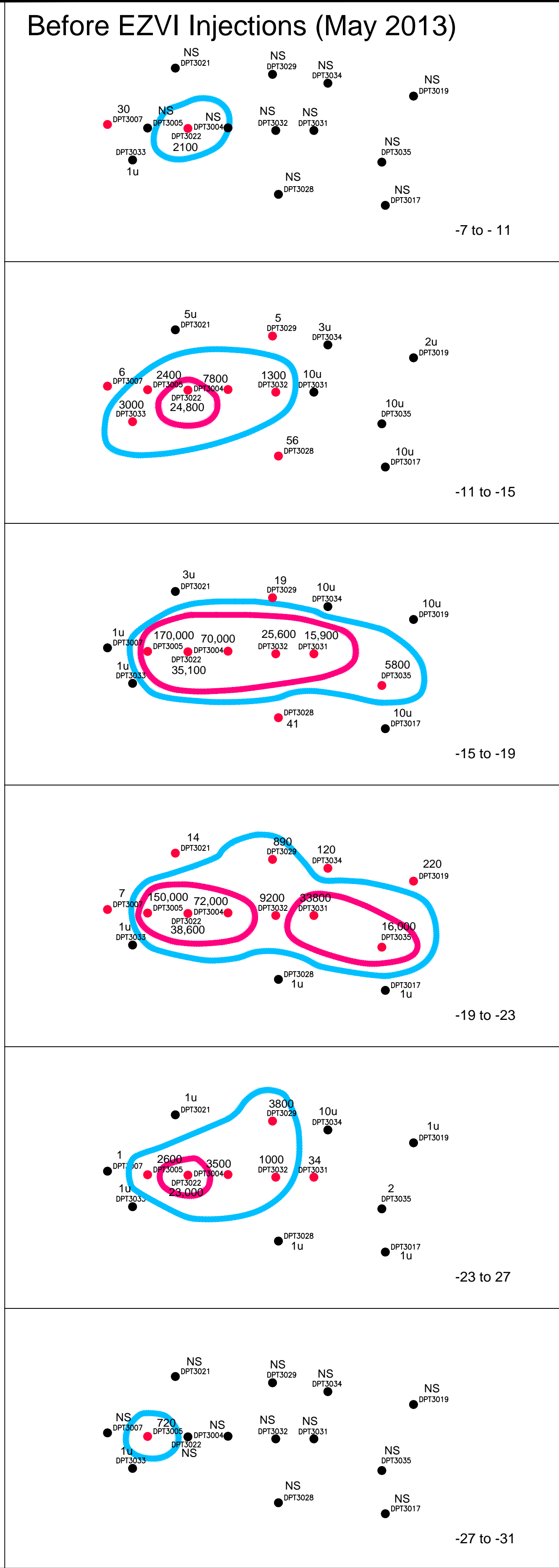
### **5.1.3 Evaluation of Potential Lateral Movement**

Performance monitoring results at perimeter locations do not indicate contaminant movement. As a check, the molar concentration of the target VOCs at baseline (526  $\mu\text{mol/L}$ ) at baseline was compared to the March 2015 calculation (41  $\mu\text{mol/L}$ ). Virtually all the mass consists of vinyl chloride. The reduction of 92% of the target VOC mass at the perimeter does not indicate either a spread of contaminants from the hot spot or a proliferation of breakdown products.

## **5.2 RECOMMENDATIONS**

It is recommended that a third post-injection performance monitoring sampling event be performed to continue to evaluate the effectiveness of the IM. Sample locations should mirror select locations from the previous performance monitoring sampling events to allow continued comparison of baseline (pre-injection) data with the performance (post-injection) data (Figure 5-4). An additional sample location is recommended west of DPT3021 to monitor for potential movement of mass from injection activities. Data should also be used to assess whether there is a potential for dechlorination to stall and if a supplemental treatment is advisable. UIC parameters are also recommended to be completed at select DPT locations during the third performance monitoring sampling event.





**PCE inferred Volume Comparison**  
Note:  
Z axis is exaggerated on drawing for presentation purposes.

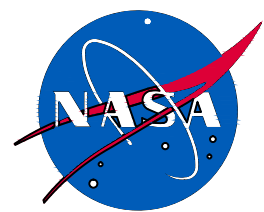
Depths in feet	Before EZVI		After EZVI		Reduction
PCE 300ppm	sf	cf	sf	cf	
-7 to -11	490	1960	0	0	
-11 to -15	2075	8300	490	1960	
-15 to -19	3285	13140	180	720	
-19 to -23	3810	15240	380	1520	
-23 to -27	1970	7880	390	1560	
-27 to -31	270	1080	0	0	
Total cf		47600		5760	
				12.10%	87.90%
PCE 10,000ppm					
-7 to -11	0	0	0	0	
-11 to -15	290	1160	0	0	
-15 to -19	1880	7520	0	0	
-19 to -23	1640	6560	130	520	
-23 to -27	205	820	150	600	
-27 to -31	0	0	0	0	
Total cf		16060		1120	
				6.97%	93.03%

**Legend:**

- DPT Sample Locations PCE Below GCTL with Results
- DPT Sample Locations PCE Above GCTL with Results
- PCE 300 ug/L Concentration inferred Isoleph
- PCE 10,000 ug/L Concentration inferred Isoleph
- u = Analyte not Detected
- NS = Not Sampled

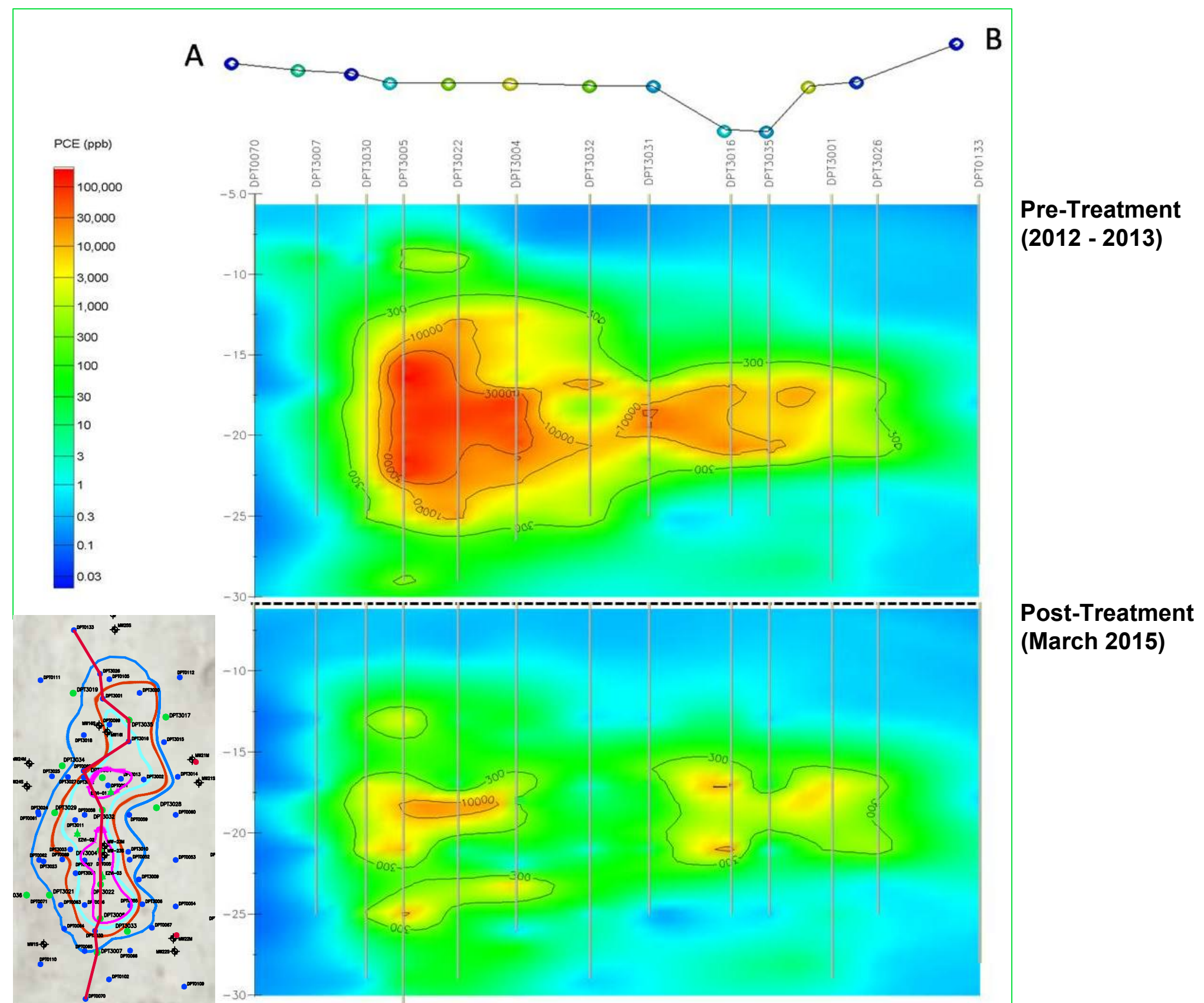
Plan View  
GRAPHIC SCALE  
0' 30' 60'  
SCALE: 1" = 30'

Figure 5-1





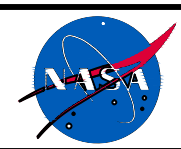
I:\NASA\35DK3802\CADD\FIGURES\DPTMONITORING.DWG  
TAB: Figure\_5-2a



**PCE Cross Section with 300, 10,000, 30,000 ppb Isopleths (Historical and PM Data)**

Figure 5-2a

PN:	35DK3802
Prepared By:	R.Ashton
Date:	09/16/15
Ref:	DPTMonitoring.dwg

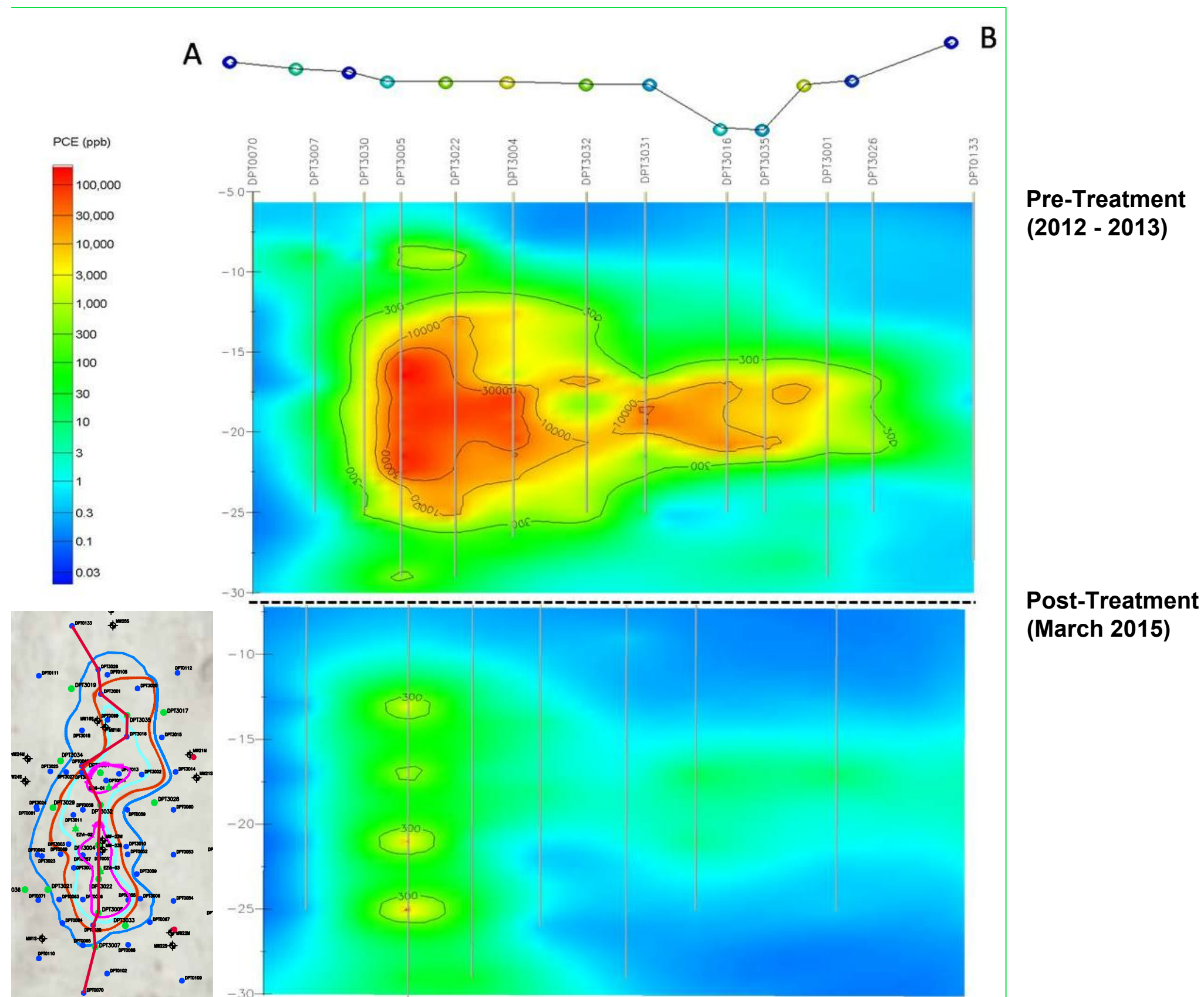


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GSA Reclamation Yard  
Southwest Hot Spot Interim Measure  
Pre- and Post-Treatment PCE Cross-Section Using EVS



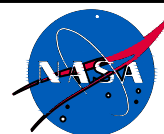
I:\NASA\35DK3802\CADD\FIGURES\DPTMONITORING.DWG  
TAB: Figure\_5-2b



**PCE Cross Section with 300, 10,000, 30,000 ppb Isopleths (PM Data Only for Post-Treatment)**

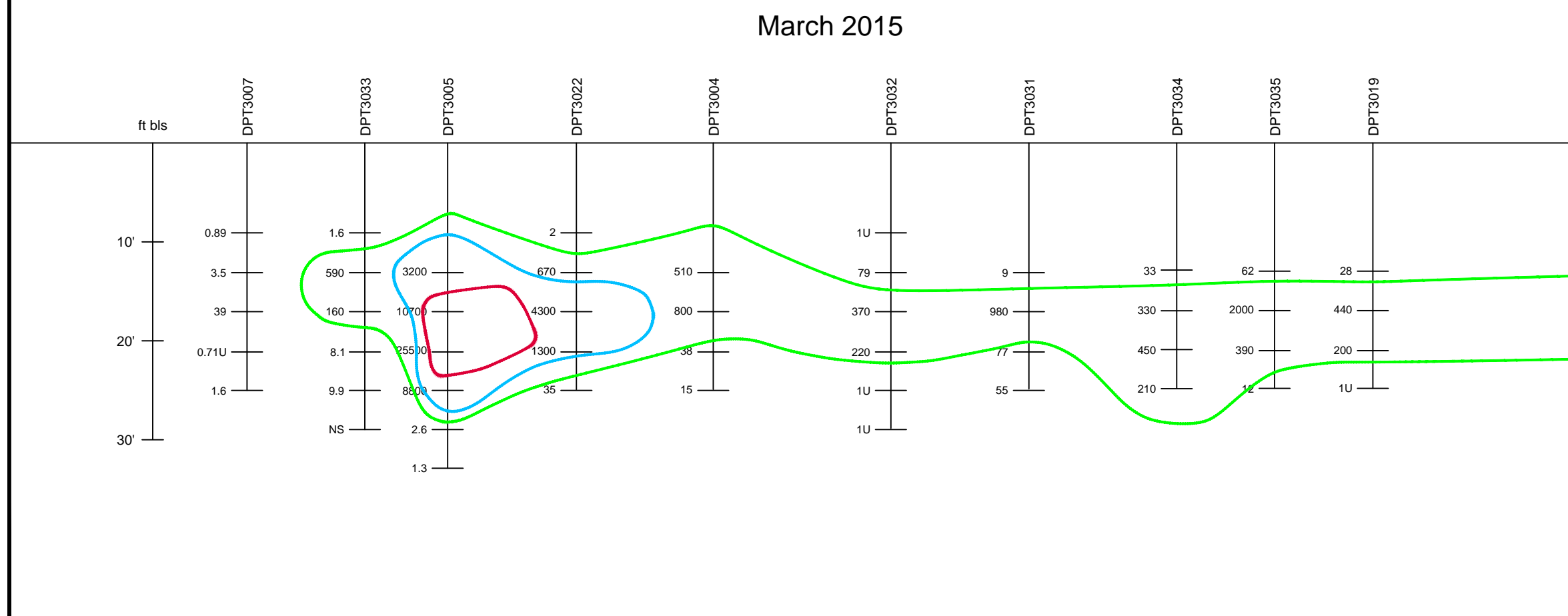
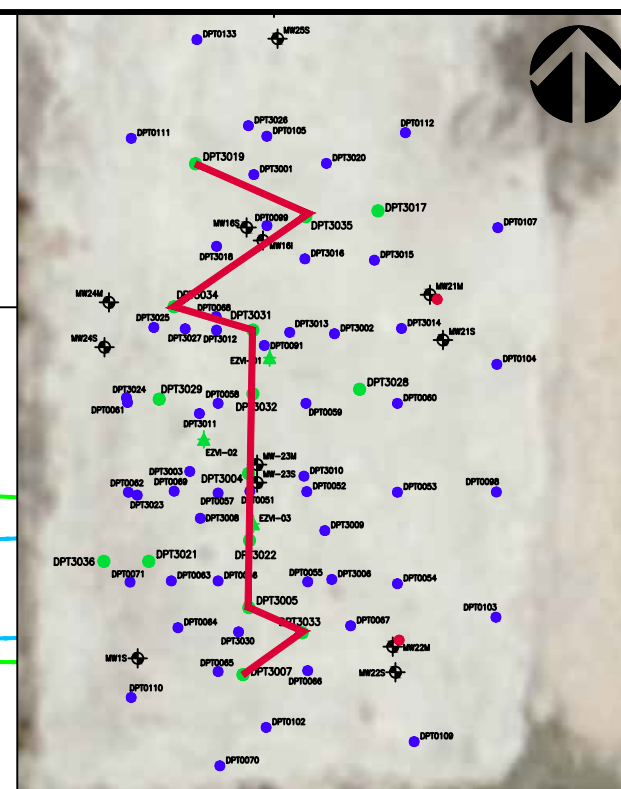
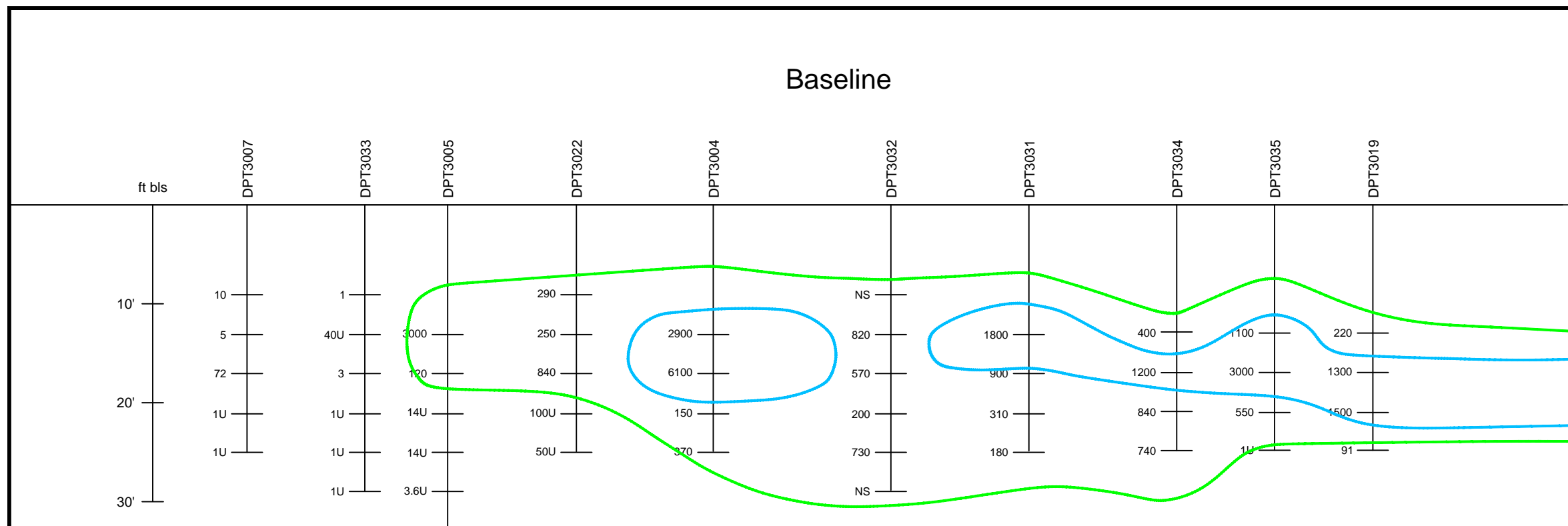
Figure 5-2b

PN:	35DK3802
Prepared By:	R.Ashton
Date:	09/16/15
Ref:	DPTMonitoring.dwg



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GSA Reclamation Yard  
Southwest Hot Spot Interim Measure  
Pre- and Post-Treatment PCE Cross-Section Using EVS



### Legend

-  100 µg/L Vinyl Chloride  
 1,000 µg/L Vinyl Chloride  
 10,000 µg/L Vinyl Chloride

## Notes

1. Results for vinyl chloride are in micrograms per liter ( $\mu\text{g/L}$ ).
2. NS = No Sample
3. Isopleths are inferred.

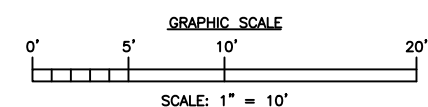


Figure 5-3

I:\NASA\35DK3802\CADD\FIGURES\DPTMONITORING.DWG  
TAB: Figure\_5-4



**Legend:**

PCE Concentration in ug/L

300 ug/L

10,000 ug/L

Isopleths are inferred.

xxxx Groundwater Sampling Location

Existing Chain Link Fence

Facility/Structure

**Note:**

DPT3036 is a new groundwater sampling location

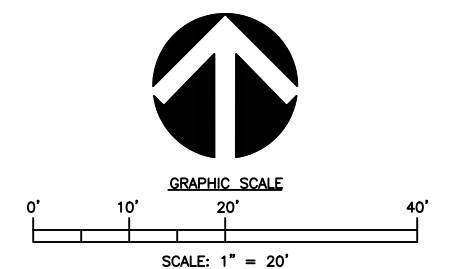
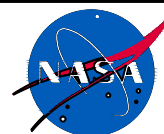


Figure 5-4

PN:	35DK3802
Prepared By:	R.Ashton
Date:	10/24/13
Ref:	DPTMonitoring.dwg



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SPACE ADMINISTRATION

GSA Reclamation Yard  
Southwest Hot Spot Interim Measure  
Sample Locations for Performance Monitoring - Event 3

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**Appendix A**

**KSC REMEDIATION TEAM MINUTES  
GSA RECLAMATION YARD PERFORMANCE MONITORING  
JULY 2015**

**Appendix A**

**KSC REMEDIATION TEAM MINUTES  
GSA RECLAMATION YARD PERFORMANCE MONITORING  
JULY 2015**

## Revision 1 Meeting Minutes for July 16, 2015

### Revision 1 Meeting Minutes for July 16, 2015

#### Attendees:

John Armstrong/FDEP  
Rosaly Santos-Ebaugh/NASA  
Dinh Vo/NASA  
Harry Plaza/NASA  
Anne Chrest/NASA  
Mike Deliz/NASA  
Ryan O'Meara/NASA  
Tim Mrdjenovich/IHA  
Deda Johansen/Jacobs  
Chris Adkison/Jacobs  
Harlan Faircloth/Core

Tom Peel/Geosyntec  
Melissa Hensley/Geosyntec  
Jill Johnson/Geosyntec  
Jim Langenbach/Geosyntec  
Mark Speranza/Tetra Tech  
Chris Hook/ Tetra Tech  
Debbie Wilson/Tetra Tech  
Mark Jonnet/Tetra Tech  
Chris Pike/Tetra Tech

1507-M01 Team

#### Minutes

**Discussion:** Team consensus reached that June 2015 revision 1 meeting minutes are final.

**Results:** Decision item 1507-D01

1507-M02 Chris Pike/  
Tetra Tech

#### LC39A (SWMU 008)

**Goal:** Step 4 EE, construction completion, soil interim measure

**Discussion:** LC39A is a former launch pad which operated from the mid 1960's until 2011. SpaceX currently has a 20 year lease of the complex (signed in April 2014). Soil and groundwater are media of concern; groundwater will be addressed under a separate interim measure (IM).

Soil concentrations are greater than residential soil cleanup target levels (RSCTL). Contaminants of concern (COC) include metals (arsenic, barium, copper, thallium, nickel, and lead), carcinogenic polycyclic aromatic hydrocarbons (cPAHs), polychlorinated biphenyls (PCBs), total recoverable petroleum hydrocarbons (TRPH), and dioxin/furans. Depth of contamination varies from 0.5 ft BLS to below the water table (2 to 5 ft BLS).

The objective of the IM was to mitigate human health risks associated with soil contamination by removing soil with COC concentrations greater than RSCTL. Forty-three areas were identified with soil concentrations greater than RSCTLs in the baseline re-assessment report. Two of these areas were eliminated



## Revision 1 Meeting Minutes for July 16, 2015

Team consensus reached to continue IM operations in all zones until Hot Spot 3 and/or Hot Spot 4 come online.

Team consensus reached to discontinue operations in zones that have achieved GCTLs to evaluate potential rebounding, once Hot Spot 3/Hot Spot 4 come online.

Team consensus reached to continue quarterly performance monitoring as completed in Year 1, to determine if operational zones achieve GCTLs, and if rebounding conditions occur in zones that will be deactivated.

Team consensus reached to continue annual IGWM sampling of MWs 13, 12, and 56.

**Results:** Decision item 1507-D15 to D17

1507-M06

Chris Adkison/  
Jacobs

General Services Administration Reclamation Yard (SWMU 010)

**Goal:** Present Southwest Hot Spot post-ERD injection performance monitoring results.

**Discussion:** The corrective action objective (CAO) for the western plume at GSRY is to clean up chlorinated VOCs to GCTLs. The objective of the ERD interim measure is to reduce significant tetrachloroethene (PCE) mass in the source zone and hot spot as well as reduce PCE and other VOC concentrations in high concentration plume to promote overall degradation of the plume, ultimately reducing time to reach the CAO.

Baseline DPT sampling conducted during December 2012 and April/May 2013. Maximum results of PCE was 214,000 parts per billion (ppb) and TCE was 16,000 ppb.

The primary source zone A (PCE greater than 30,000 ppb):

- Injected EZVI at a concentration equal to 15% pore volume
- Pore space based upon a 6 ft radius of influence and 2 ft vertical thickness
- Injection locations spaced 10 ft apart ensuring overlap
- 18 total points, injection depths depended on area but ranged from 11 to 27 ft BLS, 64 gallons of EZVI per lift; 7,168 gallons EZVI total



## Revision 1 Meeting Minutes for July 16, 2015

Primary source zone B (PCE from 10,000 to 30,000 ppb):

- Provided EZVI at a concentration equal to 10% pore volume
- Pore space based upon a 6 ft radius of influence and 2 ft vertical thickness
- 10 total points, injection depth all 15 to 23 ft BLS
- 44 gallons EZVI per lift, 1,892 gallons of EZVI total.

High concentration plume area (PCE from 300 to 10,000 ppb)

- Injection vegetable oil/lactate at a concentration equal to 6% pore volume
- Pore space based upon a 12 ft radius of influence and 4 ft interval
- 10 total points, injection depths all 11 to 27 ft BLS
- 205 gallons of vegetable oil, 17 gallons lactate, and 275 gallons of water per lift.

ERD injections took place between November 12 and 21, 2013.

- total of 9,060 gallons of EZVI were injected.
- 26,000 gallon total vegetable oil/lactate injection material (10,660 gallon vegetable oil and 890 gallons of lactate)
- Total area treated with EZVI and vegetable oil/lactate was approximately 0.12 acres (5,200 sq. ft.).

Performance monitoring was conducted to replicate, to the extent practical, the location and intervals of groundwater samples collected during baseline sampling. Based on the performance monitoring results, the EZVI treatment area has had a 77% molar concentration reduction for the target compounds, the vegetable oil/lactate treatment area has had a 69% molar concentration reduction for target compounds. Target VOC molar concentrations were calculated from the baseline and second performance DPT sampling events. VC concentration increase was observed at DPT3021.

All monitoring wells within 50 ft of the injection influence were abandoned prior to EZVI/vegetable oil injections. Per FDEP approval, UIC parameters were collected from locations in close proximity to monitoring wells via DPT during the performance monitoring sampling events. UIC parameters exceed applicable screening criteria and indicate that groundwater plume conditions have not reached pre-injection conditions. Elevated results for iron

## Revision 1 Meeting Minutes for July 16, 2015

and TRPH are acceptable, since these were injected amendments. Elevated total dissolved solid levels expected, because of temporary elevation by injections; possible DPT effects on TDS since UIC performance monitoring samples were collected via DPT rather than from traditional monitoring wells.

EZVI and vegetable oil substrate injections have had success in reducing source zone and high concentration plume VOC concentrations. The perimeter performance monitoring DPT locations do not indicate contaminant movement.

Following the third DPT performance monitoring (planned for September/October 2015), analytical results will be evaluated to determine if supplemental injections are needed (anticipated 3 to 5 years following initial injections).

1507-M07 Team

### Manhole Study (Manhole Dewatering Operations, PRL 204)

**Discussion:** NASA is in the process of drafting a response to the most recent comments received. FDEP wants to get this wrapped up soon. FDEP's contract reviewers at UF are not familiar with NASA's DPD, how institutional controls will be applied, internal procedures, internal requirements, etc. NASA has language in place and a procedure with the checklist, NASA will provide this information to FDEP and UF.

1507-M08 Team

### LC-39 Lagoonal Study (LC-39 Area Ecological Risk Assessment)

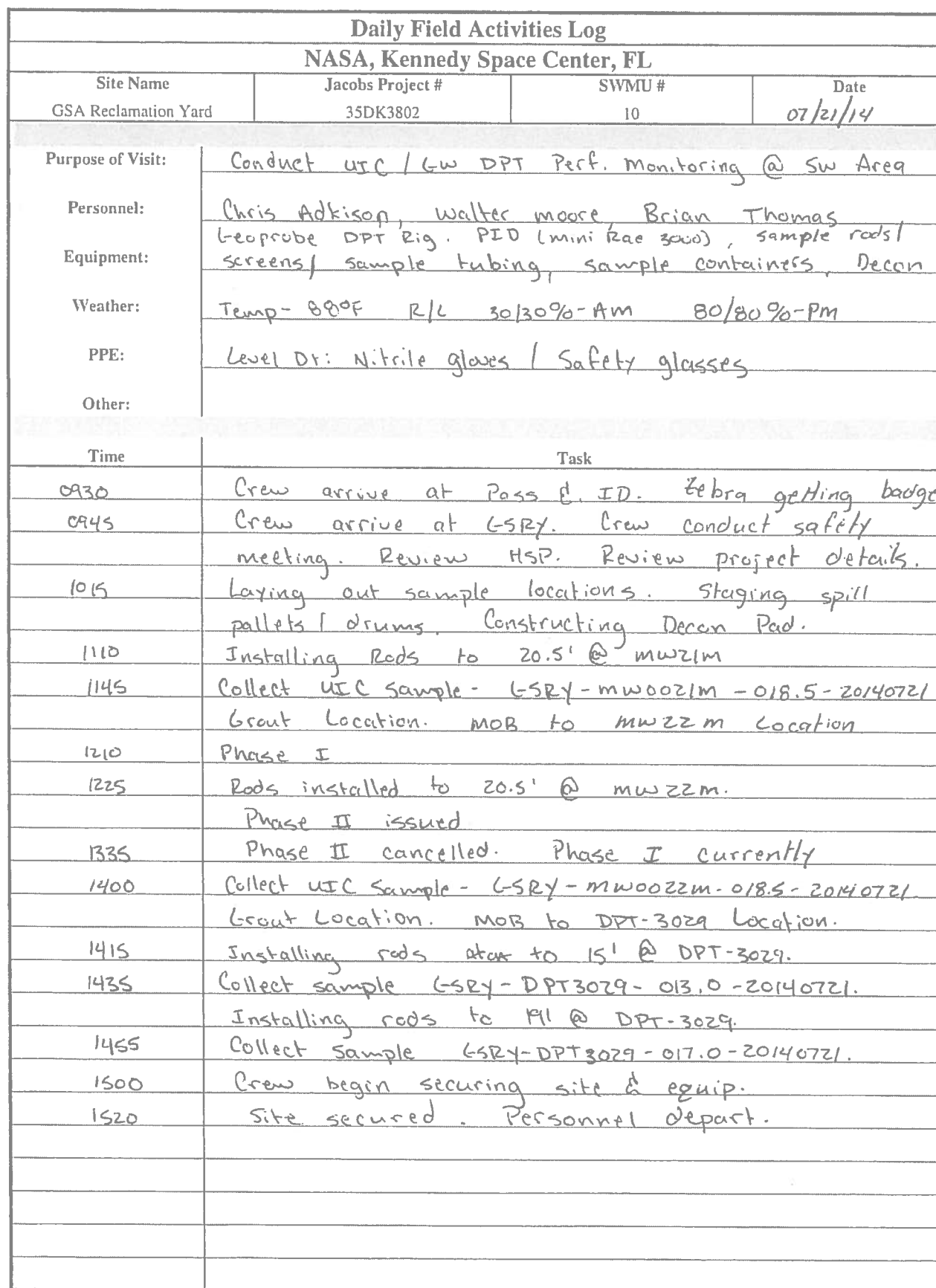
**Discussion:** The final decision of the outcome of this study will be a FDEP management decision. NASA needs to prepare a presentation to give to FDEP management so they are up to speed on where we are with the study, assumptions, etc. FDEP needs to be informed regarding all the things that NASA does to protect environment. An online meeting would be the best fit for FDEP. The reality is that it is a risk management decision. Response to comments have been submitted. Another issue is how to define these areas in the field. August 3 - 5, NASA is not available to meet. FDEP will attempt to schedule a meeting the second week of August 2015. Bottom line is dig or don't dig; if you dig, what cleanup target do you dig to? Again, UF not familiar with NASA's DPD and how institutional controls are applied.

1507-M09 Team

### Agenda Items for September 3<sup>rd</sup> and 4<sup>th</sup>, 2015

EEs will be due Aug 6<sup>th</sup>

**Appendix B**  
**FIELD LOGS**



[illegible]



Daily Field Activities Log			
NASA, Kennedy Space Center, FL			
Site Name	Jacobs Project #	SWMU #	Date
GSA Reclamation Yard	35DK3802	10	07/23/14
Purpose of Visit:	Conduct DPT GW/soil Per. Mon. @ SW Area		
Personnel:	Chris Adkison, Walter Moore, Brian Thomas		
Equipment:	DPT rig, PID, sample rods/screens, sample tubing, sample containers, Decen		
Weather:	Temp. 90 °F R/L 30/30% AM 80/80% PM		
PPE:	Level Dr: Nitrile gloves / safety glasses		
Other:			
Time	Task		
0700	Crew on-site. Conduct safety meeting.		
0715	Pulling rods at EZUI02. MOB to EZUI01.		
0730 -	Collect soil macrocores from EZUI-01, over		
1005	the 11-31 ft. interval. Visible findings documented in logbook. Crew had issue w/ the 21-26' core sand locking. Crew had to collect core from adjacent location.		
1015	Grouting EZUI01.		
1100	Grouting EZUI02 & EZUI03 locations.		
1230	Locations grouted. Break for lunch.		
1300	Crew MOB to DPT-3035		
1315	Install rods to 15' @ DPT-3035		
1335	Collect sample GSRV- DPT3035- 013.0-20140723		
	Install rods to 19'.		
1400	Collect sample GSRV- DPT3035- 017.0-20140723.		
	Install rods to 23'.		
1425	Collect sample GSRV- DPT3035- 021.0-20140723.		
	Install rods to 27'.		
1435	Collect sample GSRV- DPT3035- 025.0-20140723.		
	Pulling rods & grouting DPT3035.		
1510	DPT-3035 grouted. Securing site.		
1525	Site equip/secured. Personnel depart.		

Daily Field Activities Log			
NASA, Kennedy Space Center, FL			
Site Name	Jacobs Project #	SWMU #	Date
GSA Reclamation Yard	35DK3802	10	07/24/14
Purpose of Visit:	Conduct DPT GW Sampling @ SW Area.		
Personnel:	Chris Adkison, Walter Moore, Brian Thomas		
Equipment:	DPT rig, PID, sample rods/screens, sample tubing, sample containers, Decon		
Weather:	Temp. 90°F R/L 20/20% Am 60/60% PM		
PPE:	Level DT: Nitrile gloves / safety glasses		
Other:			
Time	Task		
0700	Crew on-site. Conduct safety meeting.		
0715	Calibrate PID. set-up at DPT-3031.		
0730	Install rods to 15 ft. @ DPT3031		
0758	Collect sample G-SRY- DPT3031- 013.0 - 20140724.		
	Install rods to 19 ft. @ DPT3031		
0825 <del>0850</del>	Collect sample G-SRY- DPT3031- 017.0 - 20140724		
	Install rods to 23 <sup>2 1/2</sup> ft. @ DPT3031.		
0900	G-SRY - DPT3031- 021.0 - 20140724 Collected.		
	Install rods to 27 ft. @ DPT3031.		
0920	mowing outside fence begins.		
	Collect sample G-SRY- DPT3031- 025.0 - 20140724.		
	Pulling rods and grouting location		
0955	Install rods to 16.5' @ DPT-3004		
1018	Collect sample G-SRY- DPT3004- 014.5 - 20140724.		
	Install rods to 20.5' @ DPT-3004.		
1045	Collect sample G-SRY- DPT3004- 018.5 - 20140724		
	Install rods to 24.5' @ DPT-3004		
1110	Collect sample G-SRY- DPT3004- 022.5 - 20140724		
	Install rods to 28.5' @ DPT-3004		
1135	Collect sample G-SRY- DPT3004- 026.5 - 20140724.		
	Pulling rods & grouting DPT-3004.		
1200	DPT-3004 grouted. Break for lunch.		
1230	on-site. Crew setting-up at DPT-3005		
1235	Install rods to 15' @ DPT3005.		
1300	Collect sample G-SRY- DPT3005- 013.0 - 20140724		





Daily Field Activities Log			
NASA, Kennedy Space Center, FL			
Site Name	Jacobs Project #	SWMU #	Date
GSA Reclamation Yard	35DK3802	10	08/04/14
Purpose of Visit:	Collect DPT Gw Samples from SW Area - VC Plume		
Personnel:	Chris Adkison / wateur walter Moore / Dan Mullin		
Equipment:	DPT Rig / PID / DPTs sampling rods & screen / Per. Pump / Sample Tubing / PPE / Decon		
Weather:	High Temp. 89°F R/L - 60/60% All Day		
PPE:	Level Dt: Nitrile gloves, Safety glasses		
Other:			
Time	Task		
0900	Personnel on-site. Calibrating PED.		
	Conduct Safety meeting. Loading supplies / equip.		
0940	Crew set-up at DPT-3036. Coring through asphalt. Conducting utility clearance.		
0950	Installing rods to 8' @ DPT 3036.		
1010	Collect GSRy-DPT3036-006.0-20140804. Install rods - 12'		
1035	Collect GSRy-DPT3036-010.0-20140804. Install rods - 16'		
1055	Collect GSRy-DPT3036-014.0-20140804. Install rods - 20'		
1115	Collect GSRy-DPT3036-018.0-20140804. Install rods - 24'		
1140	Collect GSRy-DPT3036-022.0-20140804. Install rods - 28'		
1205	Collect GSRy-DPT3036-026.0-20140804.		
	Pulling rods & grouting DPT-3036.		
1230	DPT 3036, grouted. MOB to DPT-3037.		
	Crew set-up at DPT-3037. <del>at</del> Crew performing utility clearance at DPT-3037.		
1245	Installing rods to 8' @ DPT-3037.		
1305	Collect GSRy-DPT3037-006.0-20140804. Install rods - 12'.		
1330	Collect GSRy-DPT3037-010.0-20140804. Install rods - 16'.		
1345	Collect GSRy-DPT3037-014.0-20140804. Install rods - 20'.		
1410	Collect GSRy-DPT3037-018.0-20140804. Phase II anticipated w/in 10-15 min. Prep site for Phase II.		
1415	Phase II lightning warning issued.		
1515	Phase II still in-effect. Crew depart site.		

Daily Field Activities Log			
NASA, Kennedy Space Center, FL			
Site Name	Jacobs Project #	SWMU #	Date
GSA Reclamation Yard	35DK3802	10	08/05/14
Purpose of Visit:	Collect DPT GW Samples from SW Area- VC Plume		
Personnel:	Chris Adkison, walter moore, Dan Mullin		
Equipment:	DPT Rig, PID, DPT Sampling rods & screens, Peristaltic Pump, Sample tubing, PPE, Decon		
Weather:	High Temp. 88°F R/L Chance 30/20% AM 80/80% PM		
PPE:	Level D: Nitrile gloves, Safety glasses		
Other:			
Time	Task		
0700	Personnel on-site. Conduct safety meeting.		
	Calibrate PID. Loading supplies / equipment.		
0730	Crew setting-up, MOB to DPT 3037.		
0740	Installing rods to 24' @ DPT 3037		
0800	Collect GSRV-DPT3037-022.0-20140805. Install rod - 28'.		
0850	Collect GSRV-DPT3037-026.0-20140805.		
	Pulling rods and grouting DPT 3037.		
0915	DPT 3037 grouted. MOB to DPT 3038.		
0930	Set-up at DPT 3038. Installing rods to 8'.		
0950	Collect GSRV-DPT3038-006.0-20140805. Install rods - 12'		
1010	Collect GSRV-DPT3038-010.0-20140805. Install rods - 16'		
1035	Collect GSRV-DPT3038-014.0-20140805. Install rods - 20'		
1100	Collect GSRV-DPT3038-018.0-20140805. Install rods - 24'		
1125	Collect GSRV-DPT3038-022.0-20140805.		
	Pulling rods and grouting DPT 3038.		
1140	DPT 3038 grouted. MOB to DPT 3039.		
1145	Set-up at DPT 3039. Installing rods to 8'.		
1200	Collect GSRV-DPT3039-006.0-20140805. Install rods - 12'.		
1215	Collect GSRV-DPT3039-010.0-20140805. Install rods - 16'		
1230	Collect GSRV-DPT3039-014.0-20140805. Install rods - 20'		
1255	Collect GSRV-DPT3039-018.0-20140805. Install rods - 24'		
1320	Collect GSRV-DPT3039-022.0-20140805.		
	Pulling rods and grouting DPT 3039.		
1340	Phase I lightning warning issued.		
1345	DPT 3039 grouted. MOB to DPT 3040.		



Daily Field Activities Log			
NASA, Kennedy Space Center, FL			
Site Name	Jacobs Project #	SWMU #	Date
GSA Reclamation Yard	35DK3802	10	03/23/15
Purpose of Visit:	Conduct SW Hotspot DPT PM Sampling		
Personnel:	Chris Adkison (JE), Walter Moore, & Joshua Mainard (Zebra), ALF Mobile Lab		
Equipment:	DPT Geo probe Rig, DPT sample rods/screens, poly tubing, silicone tubing, sample containers, PID, hand tools, pump		
Weather:	High Temp. 78°F, R/L 100/20% AM 100/60% PM		
PPE:	Level D: Nitrile gloves / safety glasses		
Other:	pg. 1 of 2		
Time	Task		
0815	Zebra crew has been badged. Crew arrive on-site. Crew conduct safety meeting. Crew laying out sample locations. Crew checking out inspecting equipment. Crew setting up decor pad.		
0920 <del>0850</del> CA	ALF mobile Lab on-site. Crew setting up at DPT-3035 for sample collection. will perform utility clearance at DPT 3035.		
1000	Collect GSRV- DPT3035 - 013.0 - 20150323. Install Rods to 19' @ DPT3035.		
1047	Collect GSRV- DPT3035 - 017.0 - 20150323 Install Rods to 23' @ DPT3035 Note: Between 1025-1035 Crew lost tooling (Rods and screen), attempted retrieval. Crew had to re-install new screen and rods for 15-19' sample collection.		
1110	Collect GSRV- DPT3035 - 021.0 - <del>021.0</del> 20150323. Install rods to 27 ft. @ DPT3035.		
1135	Collect GSRV- DPT3035 - 25.0 - 20150323. Pulling rods & grouting DPT3035.		
1150	Crew MOB and setting-up at DPT 3031. will install rods to 15' @ DPT3031.		
1210	Collect GSRV- DPT3031-013.0 - 20150323. Install Rods to 19' @ DPT-3031.		
1225	Collect GSRV- DPT3031- 017.0 - 20150323. Install Rods to 23' @ DPT3031		

[illegible]



Daily Field Activities Log			
NASA, Kennedy Space Center, FL			
Site Name	Jacobs Project #	SWMU #	Date
GSA Reclamation Yard	35DK3802	10	03/24/15
Purpose of Visit:	Conduct sw Hotspot DPT PM Sampling		
Personnel:	Chris Adkison (JE), walter moore & Joshua mainard (Zebra), ALF mobile Lab		
Equipment:	DPT Rig, DPT Sample rods / screens, poly & silicone tubing, PP pump, sample containers, PFD, hand tools		
Weather:	High Temp. 78 °F R/L - 10/0% AM 20/0% - PM		
PPE:	Level D: Nitrile gloves / Safety glasses		
Other:	pg. 1 of 2		
Time	Task		
0710	Crew arrive on-site. Conduct safety meeting.		
	Crew checking / inspecting equip. Calibrate PFD.		
0725	Crew MOB and setting-up at DPT3032.		
	will install rods to 11 ft. @ DPT3032		
0750	Collect GSRV- DPT3032-009.0-20150324.		
	Install rods to 15 ft. @ DPT3032.		
0810	Collect GSRV- DPT3032-013.0-20150324		
	Install rods to 19 ft. @ DPT3032.		
0830	Collect GSRV- DPT3032-017.0-20150324.		
	Install rods to 23 ft. at DPT3032.		
0845	Collect GSRV- DPT3032-021.0-20150324. Install rods to 27 ft. @ DPT3032. ALF Labs on-site.		
0910	Collect GSRV- DPT3032-025.0-20150324.		
	Install rods to 27 ft. at DPT3032		
0930	Collect GSRV- DPT3032-029.0-20150324.		
	Pulling rods and grouting DPT3032.		
0945	Crew MOB and setting-up at DPT 3034.		
	Crew will install rods to 15 ft. at DPT 3034		
1010	Collect GSRV- DPT3034-013.0-20150324.		
	Install Rods to 19 ft. @ DPT 3034		
1035	Collect GSRV- DPT3034-017.0-20150324.		
	Install Rods to 23 ft. @ DPT3034		
1055	Collect GSRV- DPT3034-021.0-20150324.		
	Install Rods to 27 ft. @ DPT3034.		



Daily Field Activities Log			
NASA, Kennedy Space Center, FL			
Site Name	Jacobs Project #	SWMU #	Date
GSA Reclamation Yard	35DK3802	10	03/24/15
Purpose of Visit:	<div style="text-align: center; transform: rotate(-30deg);"> Refer to pg. 1 </div>		
Personnel:			
Equipment:			
Weather:			
PPE:			
Other:			
Time	Task		
1115	Collect GSRV - DPT3034 - 025.0 - 20150324. Crew pulling rods and grouting DPT3034		
1130	Crew MOB and setting-up at DPT3017. Crew will install rods to 15 ft. @ DPT3017		
1145	Collect GSRV - DPT3017 - 013.0 - 20150324. Install rods to 19' @ DPT3017.		
1205	Collect GSRV - DPT3017 - 017.0 - 20150324. Install rods to 23' @ DPT3017.		
1225	Collect GSRV - DPT3017 - 021.0 - 20150324. Install rods to 27' @ DPT3017.		
1245	Collect GSRV - DPT3017 - 025.0 - 20150324. Crew pulling rods and grouting DPT3017.		
1305	Crew MOB and setting-up at DPT3028. Crew will install rods to 11' @ DPT3028.		
1330	Collect GSRV - DPT3028 - 009.0 - 20150324. Install rods to 15' @ DPT3028.		
1355	Collect GSRV - DPT3028 - 013.0 - 20150324. Install rods to 19' @ DPT3028.		
1415	Collect GSRV - DPT3028 - 017.0 - 20150324. Install rods to 23' @ DPT3028		
1435	Collect GSRV - DPT3028 - 021.0 - 20150324. Install rods to 27' @ DPT3028		
1455	Collect GSRV - DPT3028 - 025.0 - 20150324. Crew pulling rods / grouting DPT3028.		
1515	DPT3028 grouted. Securing site / equipment.		
1530	Site / equip. secured. Personnel depart.		



Daily Field Activities Log			
NASA, Kennedy Space Center, FL			
Site Name	Jacobs Project #	SWMU #	Date
GSA Reclamation Yard	35DK3802	10	03/25/15
Purpose of Visit:	Conduct SW Hotspot DPT PM Sampling		
Personnel:	Chris Adkison (JE), walter moore E Josh Mainard (Zebra)		
Equipment:	DPT Rig, DPT Sample rods / screens, poly E silicone tubing, PP Pump, sample containers, PID, handtools		
Weather:	High Temp: 80°F R/L- 10/0% AM 20/0% PM		
PPE:	Level D: Nitrile gloves / safety glasses		
Other:	pg. 1 of 3		
Time	Task		
0710	Crew arrive on-site. Conduct safety meeting.		
	Crew inspects equip. Calibrate PID.		
0735	Crew MOB and setting-up at DPT 3019. Crew will install rods to 15 ft. @ DPT 3019		
0755	Collect GSR- DPT 3019- 013.0 - 20150325.		
	Install rods to 19' @ DPT 3019		
0820	Collect GSR- DPT 3019- 017.0 - 20150325.		
	Install Rods to 23' @ DPT 3019.		
0840	Collect GSR- DPT 3019- 021.0 - 20150325.		
	Install Rods to 27' @ DPT 3019.		
0900	Collect GSR- DPT 3019- 025.0 - 20150325.		
	Pulling rods and grouting DPT 3019.		
0915	Crew MOB and setting-up at DPT 3022. Crew will install rods to 11 ft. @ DPT 3022.		
0925	Collect GSR- DPT 3022- 009.0 - 20150325.		
	Install Rods to 15' @ DPT 3022.		
0945	Collect GSR- DPT 3022- 013.0 - 20150325		
	Install Rods to 19' @ DPT 3022.		
1005	Collect GSR- DPT 3022- 017.0 - 20150325		
	Install Rods to 23' @ DPT 3022.		
1025	Collect GSR- DPT 3022- 021.0 - 20150325		
	Install Rods to 27' @ DPT 3022.		
1045	Collect GSR- DPT 3022- 025.0 - 20150325.		
	<del>Install Rods to 27' @ DPT 3022.</del> Pulling rods / grouting DPT 3022.		
1100	Crew MOB and setting-up at DPT 3005.		
	Crew will install rods to 15 ft. @ DPT 3019.		





Daily Field Activities Log			
NASA, Kennedy Space Center, FL			
Site Name	Jacobs Project #	SWMU #	Date
GSA Reclamation Yard	35DK3802	10	03/25/15
Purpose of Visit:	<div>Refer to pg. 1</div>		
Personnel:			
Equipment:			
Weather:			
PPE:			
Other:			
Time	Task		
1115	Collect GSRV- DPT3005 - 013.0 - 20150325. Install Rods to 19' @ DPT3005		
1135	Collect GSRV- DPT3005 - 017.0 - 20150325. Install Rods to 23' @ DPT3005.		
1155	Collect GSRV- DPT3005 - 021.0 - 20150325. Install Rods to 27' @ DPT3005.		
1220	Collect GSRV- DPT3005 - 025.0 - 20150325. Pulling rods and grouting DPT3005.		
1230	Crew MOB and setting-up at DPT3004. Crew will install rods to 16.5 ft. @ DPT3004.		
1230 <sup>CH</sup> 1245	Collect GSRV- DPT3004 - 014.5 - 20150325. Install Rods to 20.5' @ DPT3004		
1320	Collect GSRV- DPT3004 - 018.5 - 20150325 Install Rods to 24.5' @ DPT3004.		
1340	Collect GSRV- DPT3004 - 022.5 - 20150325. Install Rods to 28.5' @ DPT3004.		
1410	Collect GSRV- DPT3004 - 026.5 - 20150325. Crew <del>Install</del> Rods pulling rods and grouting DPT3004.		
1420	Crew MOB and setting-up at DPT3021. Crew will install rods to 15 ft. @ DPT3021.		
1435	Collect GSRV- DPT3021 - 013.0 - 20150325 Install Rods to 19' @ DPT3021		
1455	Collect GSRV- DPT3021 - 017.0 - 20150325. Install Rods to 23' @ DPT3021		



## Daily Field Activities Log

**NASA, Kennedy Space Center, FL**

[illegible]

Daily Field Activities Log			
NASA, Kennedy Space Center, FL			
Site Name	Jacobs Project #	SWMU #	Date
GSA Reclamation Yard	35DK3802	10	03/26/15
Purpose of Visit:	Finish SW Hotspot DPT PM Sampling		
Personnel:	Chris Adkison (JE), walter moore & Joshua Mainard (Zebra)		
Equipment:	DPT Rig, DPT Sample rods/screens, poly & silicone tubing, PP Pump, Sample Containers, PID, handtools		
Weather:	High Temp. 81°F R/L- 40/20% AM 80/60% PM		
PPE:	Level Dt: Nitrile gloves / Safety glasses		
Other:	pg. 1 of 2		
Time	Task		
0715	Crew arrive on-site. Conduct safety meeting.		
	Crew inspects equip. Calibrate PID.		
0730	Crew sets-up at DPT3021. Crew will install rods to 27' @ DPT3021.		
0750	Collect GSRy- DPT3021- 025.0 - 20150326. Crew pulling rods & grouting DPT3021.		
0805	Crew MOB and setting-up at DPT3007. Crew will install rods to 11' @ DPT3007.		
0815	Collect GSRy- DPT3007- 009.0 - 20150326. Install rods to 15' @ DPT3007.		
0835	Collect GSRy- DPT3007- 013.0 - 20150326. Install rods to 19' @ DPT3007.		
0855	Collect GSRy- DPT3007- 025.0 <sup>017.0</sup> - 20150326. Install rods to 23' @ DPT3007.		
0920	Collect GSRy- DPT3007- 021.0 - 20150326. Install rods to 27' @ DPT3007.		
0950	Collect GSRy- DPT3007- 025.0 - 20150326. Crew <del>Install rods for</del> Pull rods & grout DPT3007.		
1015	Crew MOB and setting-up at DPT3005. Crew will install rods to 27' @ DPT3005.		
1040	Collect GSRy- DPT3005- 025.0 - 20150326. Install rods to 31' @ DPT3005.		
1110	Collect GSRy- DPT3005- 029.0 - 20150326. Install rods to 35' @ DPT3005.		
1140	Collect GSRy- DPT3005- 033.0 - 20150326. Crew pulling rods and grouting DPT3005		

Daily Field Activities Log			
NASA, Kennedy Space Center, FL			
Site Name	Jacobs Project #	SWMU #	Date
GSA Reclamation Yard	35DK3802	10	03/24/15
Purpose of Visit:	<div style="text-align: center; transform: rotate(-15deg);">             refer to pg. 1           </div>		
Personnel:			
Equipment:			
Weather:			
PPE:			
Other:			
pg. 2 of 2			
Time	Task		
1200	Crew MOB and setting-up at DPT3033.		
	Crew will install rods to 11' @ DPT3033.		
1225	Collect GSRV- DPT3033- 009.0- 20150326.		
	Install Rods to 15' @ DPT3033.		
1245	Collect GSRV- DPT3033- 013.0- 02150326.		
	Install Rods to 19' @ DPT3033.		
1310	Collect GSRV- DPT3033- 017.0- 20150326.		
	Install Rods to 23' @ DPT3033.		
1330	Collect GSRV- DPT3033- 021.0- 20150326.		
	Install Rods to 27' @ DPT3033.		
1400	Collect GSRV- DPT3033- 025.0- 20150326.		
	Crew pulling rods and grouting DPT3033.		
1410	Crew MOB and setting-up at DPT MW0022m.		
	will install rods to 20.5' @ DPT MW0022m.		
1435	Collect GSRV- MW0022m- 018.5- 20150326.		
	Crew pulling rods and grouting DPT MW0022m.		
1445	Crew MOB and setting-up at DPT MW0021m.		
	will install rods to 20.5' @ DPT MW0021m.		
1510	Collect GSRV- MW0021m- 018.5- 20150326.		
	Crew pulling rods and grouting DPT MW0021m.		
	Crew securing site & equip.		
1530	site / equip. secured. Personnel departs.		



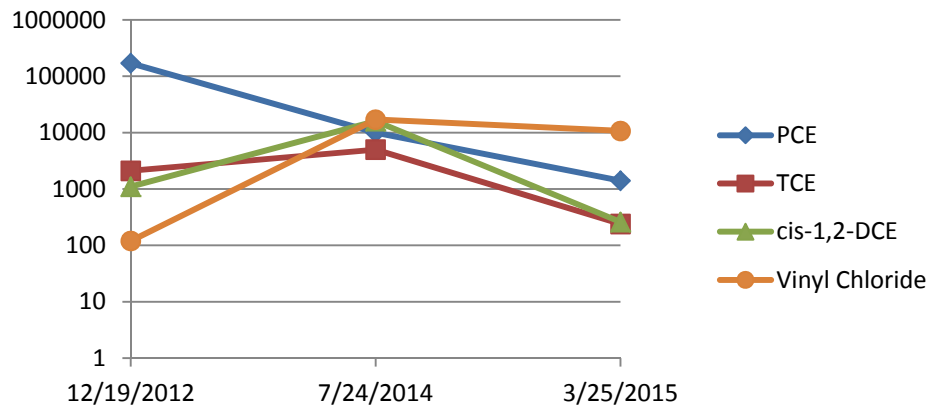
## Daily Field Activities Log

**NASA, Kennedy Space Center, FL**

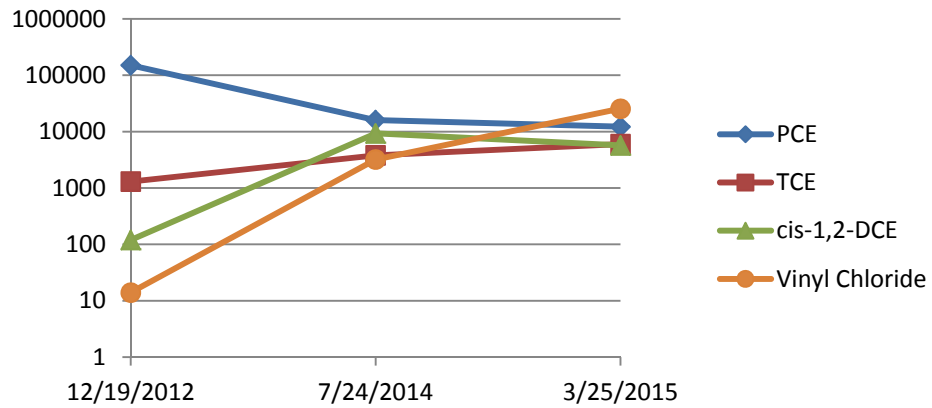
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**Appendix C**  
**TREND CHARTS**

### DPT3005 15-19'

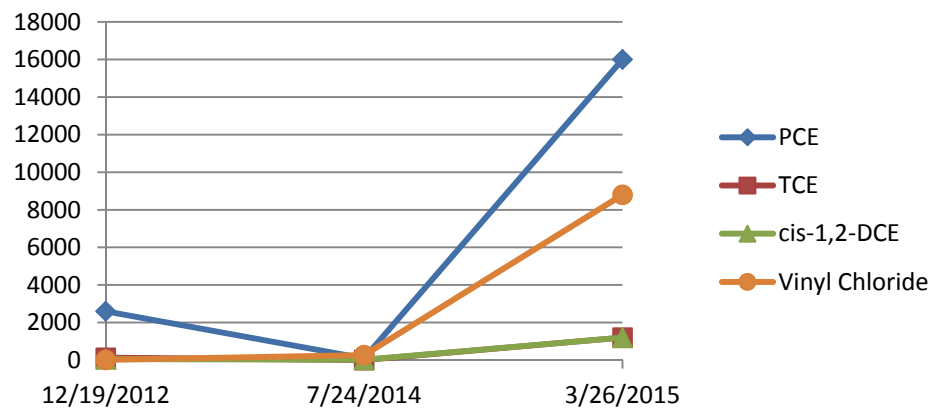


### DPT3005 19-23'

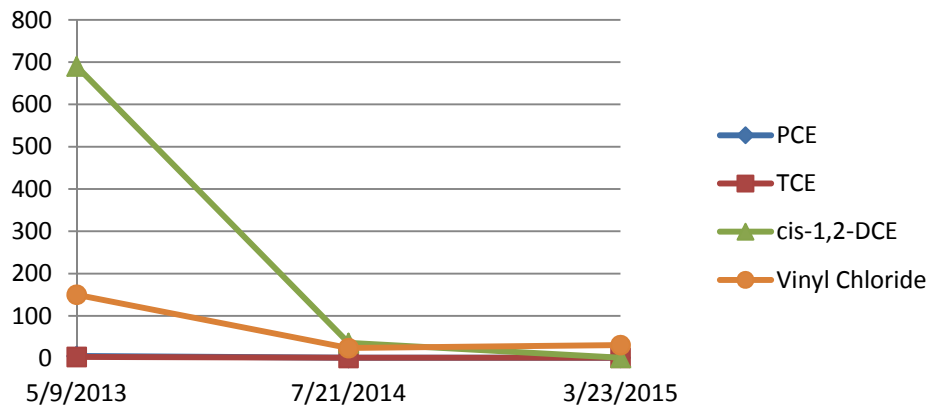




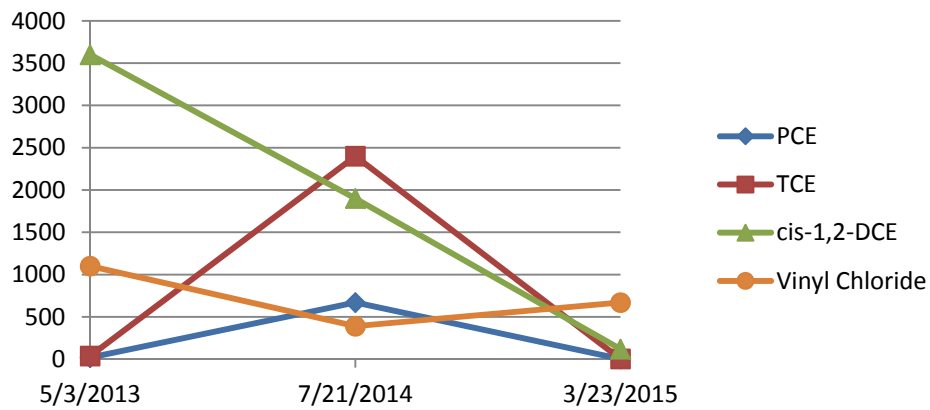
# DPT3005 23-27'



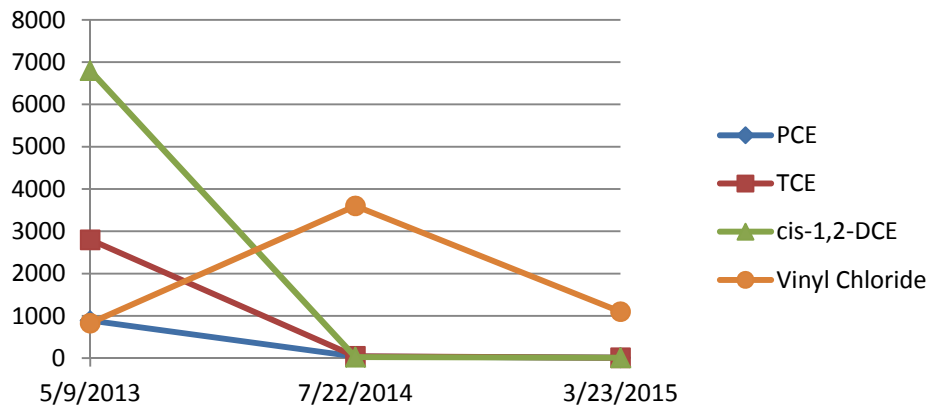
### DPT3029 11-15'



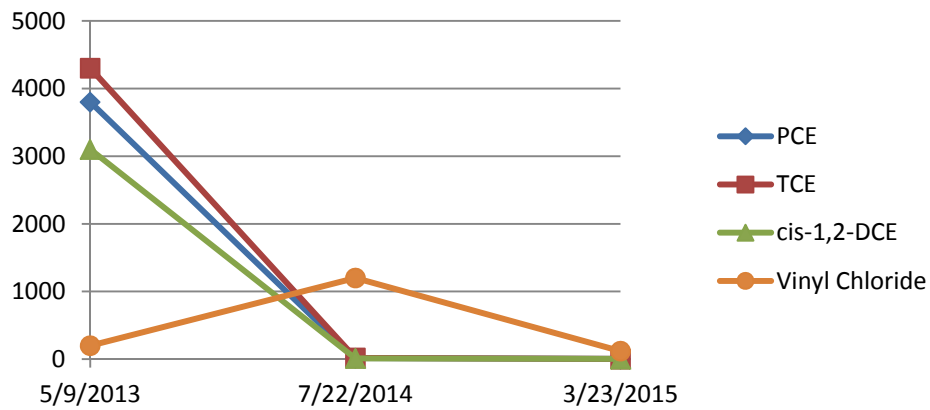
### DPT3029 15-19'



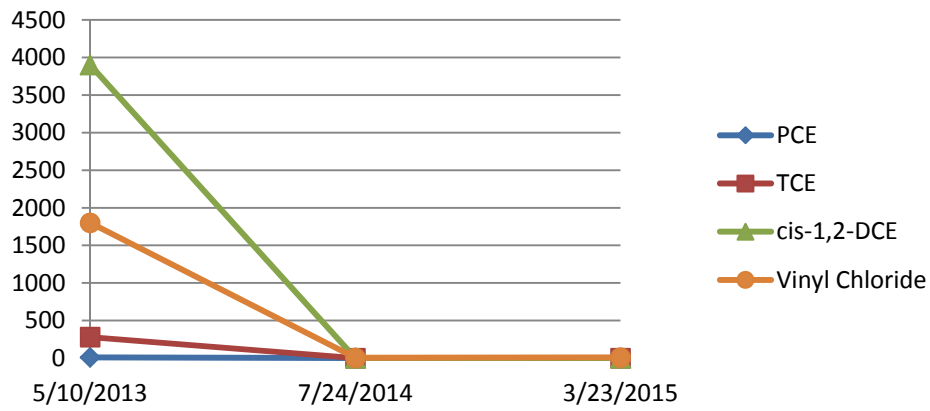
### DPT3029 19-23'



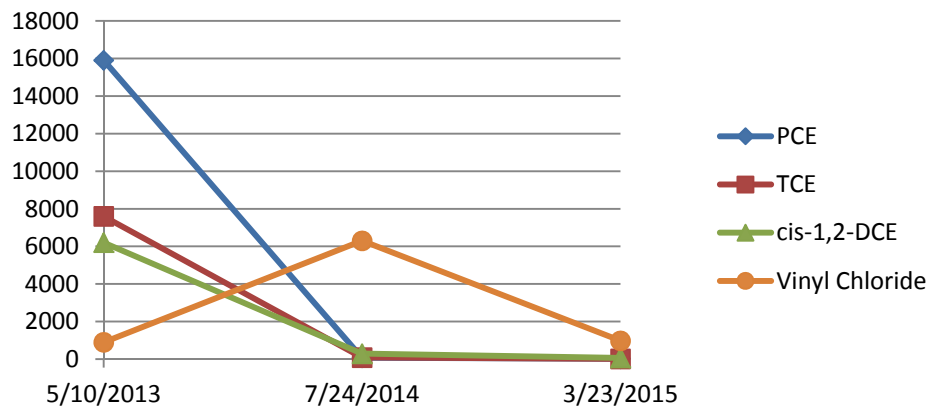
### DPT3029 23-27'



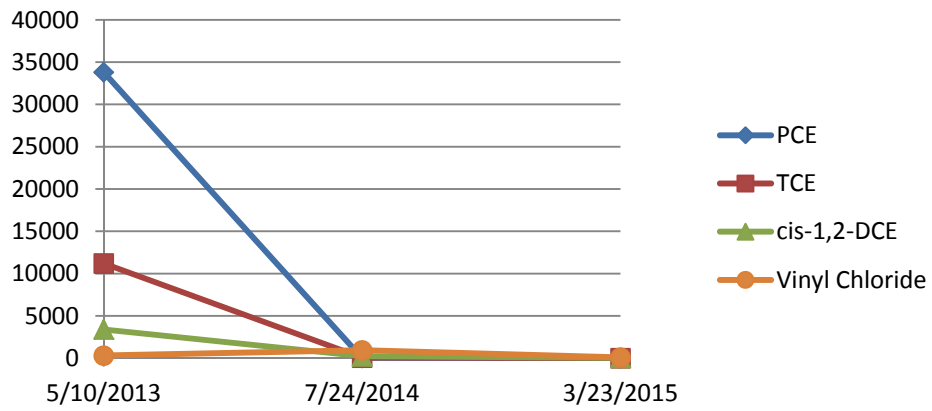
### DPT3031 11-15'



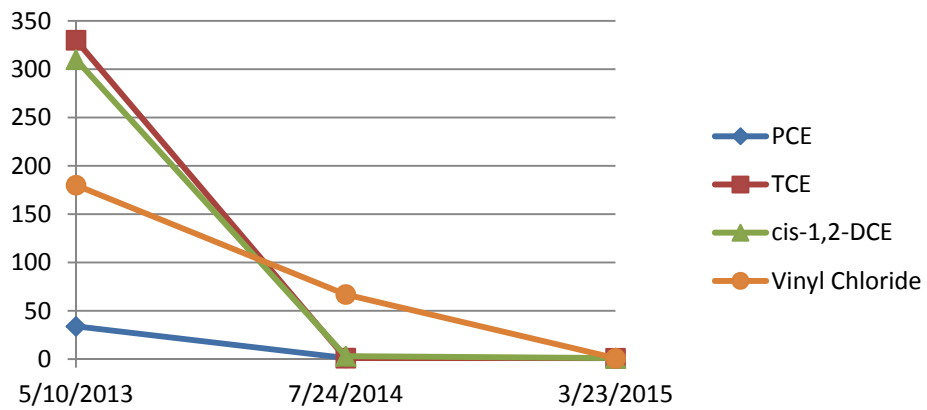
### DPT3031 15-19'



### DPT3031 19-23'

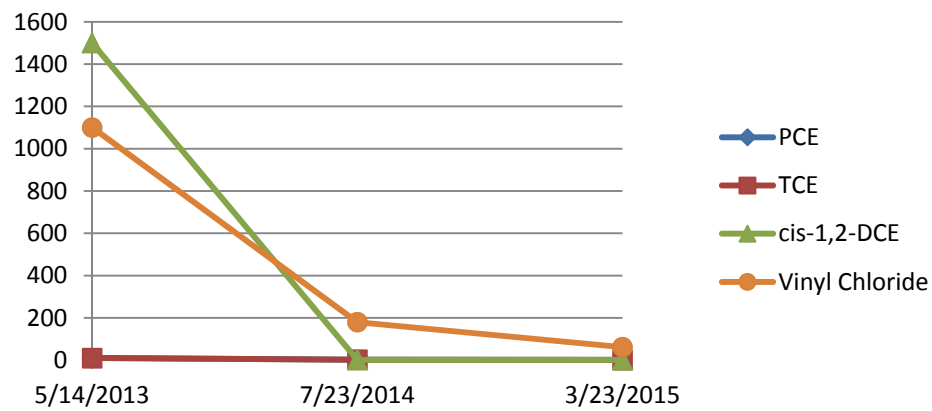


### DPT3031 23-27'

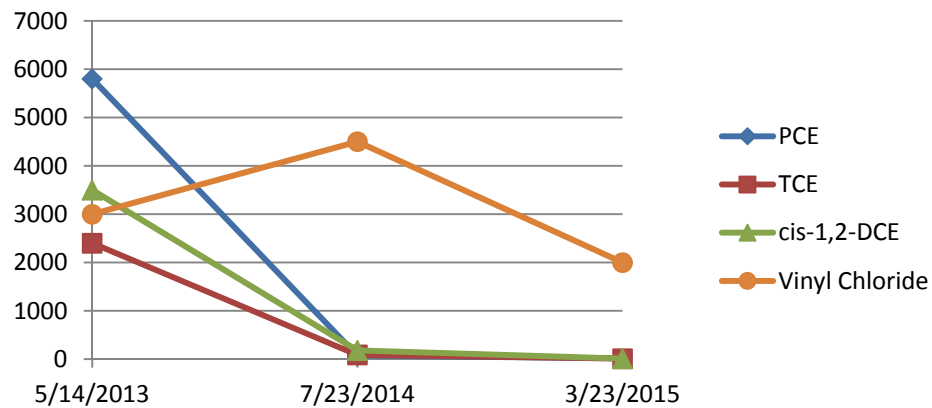




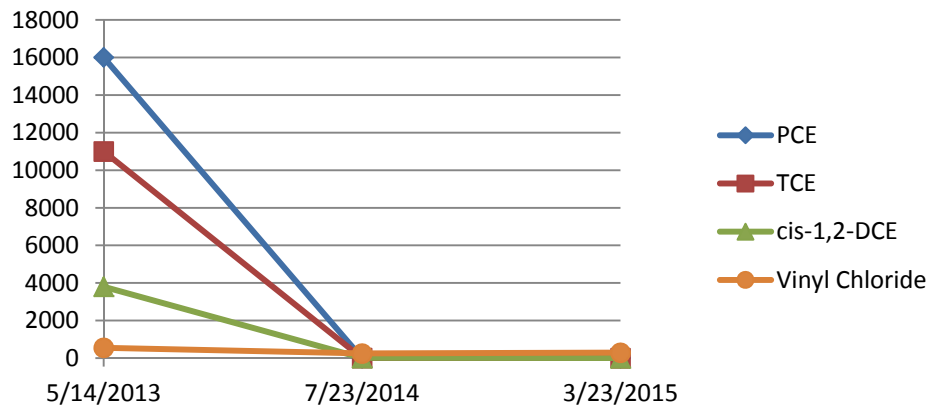
### DPT3035 11-15'



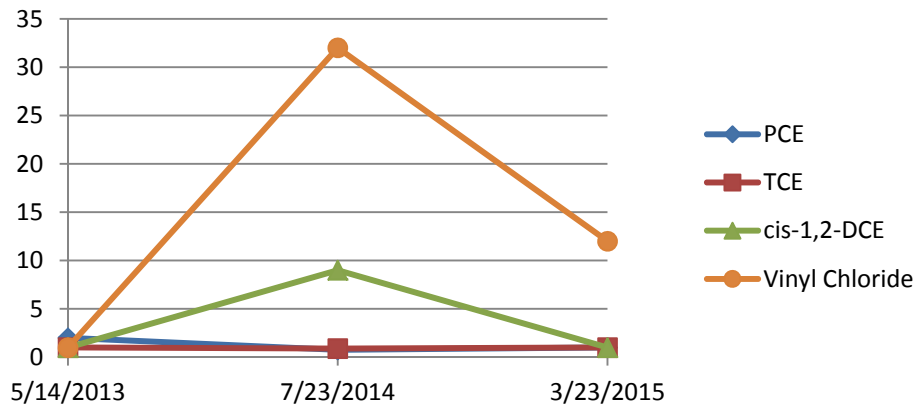
### DPT3035 15-19'



### DPT3035 19-23'



### DPT3035 23-27'



## **Appendix D**

### **MOLAR CONCENTRATION EQUIVALENT CALCULATIONS**

Molar Concentrations for Performance Indicator VOCs  
Southwest Hot Spot  
GSA Reclamation Yard (SWMU 10), Kennedy Space Center

GSRY SW  
Molar calculations

<u>Molar Concentration Summary</u>															
Cell	3004	3005	3007	3017	3019	3021	3022	3028	3029	3031	3032	3033	3034	3035	
PCE	493	1950	0.27	0.07	1.37	0.11	745.3	0.59	28.43	299.93	223.7	18.10	0.79	131.50	
TCE	152	27	0.02	3.85	12.23	1.19	198.6	9.82	54.33	147.72	270.2	4.73	30.87	102.02	
cis-1,2-DCE	104	13	0.13	52.70	68.44	12.05	79.2	42.32	146.44	142.52	141.4	4.15	72.76	90.82	
Vinyl chloride	51	2.2	1.26	70.65	49.78	5.28	23.3	57.11	36.48	51.04	37.1	0.39	50.88	74.41	
Pre-treatment Molar Sum	800	1992	2	127	132	19	1046	110	266	641	672	27	155	398.75	
PCE	0	179	0	0	0	0	0	0	0	0	0	5	0	0.10	
TCE	0	57	0	0	0	0	0	0	0	0	0	2	0	0.06	
cis-1,2-DCE	0	74	0	0	4	0	2	0	1	1	0	3	0	0.08	
Vinyl chloride	22	720	1	8	11	138	101	0	31	17	11	12	16	37.82	
Post-treatment Molar Sum	22	1029	1	8	15	138	103	1	32	18	11	22	17	38	
PCE	-493	-1771	0	0	-1	0	-745	-1	-28	-300	-224	-13	-1	-131	
TCE	-152	30	0	-4	-12	-1	-198	-10	-54	-148	-270	-3	-31	-102	
cis-1,2-DCE	-104	61	0	-53	-64	-12	-77	-42	-145	-142	-141	-1	-73	-91	
Vinyl chloride	-29	718	-1	-63	-39	133	78	-57	-6	-34	-26	12	-35	-37	
Molar Net Change	-778	-963	-1	-119.5	-117	120	-943	-109	-234	-623	-662	-5	-139	-361	
% Change	-97%	-48%	-54%	-94%	-89%	643%	-90%	-99%	-88%	-97%	-98%	-20%	-89%	-90%	
Total Net Change*	-4933														

\*If ( - ) then total site molar concentration decreased; if ( + ) then total site molar concentration increased.

Molar Concentrations for Performance Indicator VOCs  
Southwest Hot Spot  
GSA Reclamation Yard (SWMU 10), Kennedy Space Center

	Molecular Weight	DPT3004		DPT3004		DPT3004		DPT3004		DPT3004				DPT3004		DPT3004	
		12-13		13-14		14-15		15-16		12.5-16.5				16-17		17-18	
		December 2012		December 2012		December 2012		December 2012		<--- Averages		Mar-15		December 2012		December 2012	
		g/mol	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l
Tetrachloroethene (PCE)	166	7800	47	2900	17	4300	26	4100	25	4775	29	7	0.04	1100	6.6	46000	277
Trichloroethene (TCE)	131	6100	46	4600	35	5400	41	4400	33	5125	39	5	0.04	2800	21	16000	122
cis-1,2-Dichloroethene	97	1900	20	1500	15	4100	42	5700	59	3300	34	30	0.31	8000	83	5600	58
Vinyl Chloride	63	340	5.4	230	3.7	1000	16	2900	46	1118	18	510	8.2	6100	98	690	11
Molar Sum			119		72		125		163		120		8.5		208		468
Difference													-111.18				

	Molecular Weight	DPT3004		DPT3004		DPT3004				DPT3004		DPT3004		DPT3004		DPT3004	
		18-19		19-20		16.5-20.5				20-21		21-22		22-23		23-24	
		December 2012		December 2012		<--- Averages		Mar-15		December 2012		December 2012		December 2012		December 2012	
		g/mol	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l
Tetrachloroethene (PCE)	166	70000	422	65000	392	45525	275	8	0.05	72000	434	34000	205	12000	72	3500	21
Trichloroethene (TCE)	131	7000	53	6600	50	8100	62	3	0.02	7500	57	5200	40	4500	34	3000	23
cis-1,2-Dichloroethene	97	2800	29	2600	27	4750	49	13	0.13	2100	22	920	9.5	1100	11	810	8.4
Vinyl Chloride	63	140	2.2	26	0.42	1739	28	800	13	22	0.35	62	0.99	150	2.4	120	1.9
Molar Sum		507		469		413		13		513		255		120		54	
Difference		-400.00															

	Molecular Weight	DPT3004				DPT3004		DPT3004		DPT3004		DPT3004			
		20.5-24.5				24-25		25-26		26-27		24.5-28.5			
		<--- Averages		Mar-15		December 2012		December 2012		December 2012		<--- Averages		Mar-15	
		g/mol	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l
Tetrachloroethene (PCE)	166	30375	183	0.5	0.00	2700	16	650	3.9	42	0.25	1131	6.8	0.5	0.00
Trichloroethene (TCE)	131	5050	38	0.5	0.00	3200	24	1600	12	290	2.2	1697	13	0.5	0.00
cis-1,2-Dichloroethene	97	1233	13	0.5	0.01	1100	11	970	10	290	3.0	787	8.1	0.5	0.01
Vinyl Chloride	63	89	1.4	38	0.61	200	3.2	370	5.9	120	1.9	230	3.7	15	0.24
Molar Sum			236		0.62		55		32		7.4		32		0.25
Difference					-235.11										-31.28
															-777.58

	Molecular Weight	DPT3005				DPT3005				DPT3005				DPT3005			
		7-11				11-15				15-19				19-23			
		December 2012		Mar-15		December 2012		Mar-15		December 2012		Mar-15		December 2012		Mar-15	
		g/mol	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l
Tetrachloroethene (PCE)	166	293	1.8		0.00	5068	31	3100	19	170000	1025	1400	8.4	150000	905	12200	74
Trichloroethene (TCE)	131	NS			0.00	NS		370	2.8	2100	16	240	1.8	1300.00	9.9	6000	46
cis-1,2-Dichloroethene	97	NS			0.00	NS		1500	15	1100	11	260	2.7	120	1.2	5700	59
Vinyl Chloride	63	NS			0.00	NS		3200	51	120	1.9	10700	171	7.00	0.11	25500	408
Molar Sum		1054184916586															
Difference		-870.22-329.71															

	Molecular Weight	DPT3005				DPT3005			
		23-27				27-31			
		December 2012		Mar-15		December 2012		Mar-15	
		g/mol	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l
Tetrachloroethene (PCE)	166	2600	16	16000	96	720	4.3	40	0.24
Trichloroethene (TCE)	131	130	0.99	1200	9.1	2.2	0.02	0.45	0.00
cis-1,2-Dichloroethene	97	53	0.55	1200	12	1.3	0.01	0.9	0.01
Vinyl Chloride	63	7.0	0.11	8800	141	1.8	0.03	2.6	0.04
Molar Sum			17		259		4.4		0.30
Difference					241.47				-4.11

Net Change

-962.57

Notes

NS=Not Sampled

Values with "U" qualifier are multiplied by 0.5 and highlighted in yellow  
Values with "I" qualifier are highlighted in blue



Molar Concentrations for Performance Indicator VOCs  
Southwest Hot Spot  
GSA Reclamation Yard (SWMU 10), Kennedy Space Center

	Molecular Weight	DPT3007				DPT3007				DPT3007				DPT3007											
		7-11				11-15				15-19				19-23											
		Apr-13		Mar-15		Apr-13		Mar-15		Apr-13		Mar-15		Apr-13		Mar-15									
		g/mol	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l							
Tetrachloroethene (PCE)	166	30	0.18	0.38	0.00	6	0.04	0.4	0.00	0.50	0.00	0.38	0.00	7	0.04	0.38	0.00								
Trichloroethene (TCE)	131	0.5	0.00	0.4	0.00	1	0.01	0.4	0.00	0.50	0.00	0.4	0.00	0.5	0.00	0.45	0.00								
cis-1,2-Dichloroethene	97	0.5	0.01	0.3	0.00	5	0.05	0.3	0.00	6	0.06	0.27	0.00	0.5	0.01	0.27	0.00								
Vinyl Chloride	63	0.5	0.01	0.9	0.01	5	0.08	3.5	0.06	72	1.15	39	0.62	0.5	0.01	0.36	0.01								
Molar Sum		0.20				0.02				0.18				0.63				0.06				0.01			
Difference						-0.18				-0.11				-0.59				-0.05							

	Molecular Weight	DPT3007			
		23-27			
		Apr-13		Mar-15	
		g/mol	ug/l	umol/l	ug/l
Tetrachloroethene (PCE)	166	1	0.01	0.38	0.00
Trichloroethene (TCE)	131	0.50	0.00	0.45	0.00
cis-1,2-Dichloroethene	97	0.50	0.01	0.27	0.00
Vinyl Chloride	63	0.50	0.01	1.6	0.03
Molar Sum		0.02		0.03	
Difference				0.01	

Net Change

-0.91

	Molecular Weight	DPT3017				DPT3017				DPT3017				DPT3017																			
		11-15				15-19				19-23				23-27																			
		May-13		Mar-15		May-13		Mar-15		May-13		Mar-15		May-13		Mar-15																	
		g/mol	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l															
Tetrachloroethene (PCE)	166	5	0.03	1.5	0.01	5.0	0.03	1.0	0.01	0.5	0.00	0.50	0.00	0.50	0.00	0.50	0.00																
Trichloroethene (TCE)	131	500	3.81	1.5	0.01	5.0	0.04	1.0	0.01	0.5	0.00	0.50	0.00	0.50	0.00	0.50	0.00																
cis-1,2-Dichloroethene	97	4000	41.28	1.5	0.02	1100	11	1.0	0.01	6.0	0.06	0.50	0.01	0.50	0.01	0.50	0.01																
Vinyl Chloride	63	1300	20.80	280	4.5	3100	50	180	2.9	15	0.24	18	0.29	0.50	0.01	0.50	0.01																
Molar Sum		66				4.5				61				2.9				0.31				0.30				0.02				0.02			
Difference						-61.40				-58.12				-0.01								0.00											

Net Change

-119.52

	Molecular Weight	DPT3019				DPT3019				DPT3019				DPT3019																			
		11-15				15-19				19-23				23-27																			
		May-13		Mar-15		May-13		Mar-15		May-13		Mar-15		May-13		Mar-15																	
		g/mol	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l															
Tetrachloroethene (PCE)	166	1	0.01	0.5	0.00	5.0	0.03	1.5	0.01	220	1.3	1.5	0.01	1.0	0.01	0.50	0.00																
Trichloroethene (TCE)	131	1	0.01	0.5	0.00	5.0	0.04	1.5	0.01	1600	12	1.5	0.01	1.0	0.01	0.50	0.00																
cis-1,2-Dichloroethene	97	230	2.4	0.5	0.01	1400	14	400	4.1	5000	52	1.5	0.02	2.0	0.02	0.50	0.01																
Vinyl Chloride	63	220	3.5	28	0.45	1300	21	440	7.0	1500	24	200	3.2	91	1.5	0.50	0.01																
Molar Sum		5.91				0.46				35.32				11.19				89.10				3.24				1.49				0.02			
Difference						-5.45				-24.13				-85.87								-1.47											

Net Change

-116.91

Notes  
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Molar Concentrations for Performance Indicator VOCs  
Southwest Hot Spot  
GSA Reclamation Yard (SWMU 10), Kennedy Space Center

	Molecular Weight	DPT3021				DPT3021				DPT3021				DPT3021																			
		11-15				15-19				19-23				23-27																			
		May-13		Mar-15		May-13		Mar-15		May-13		Mar-15		May-13		Mar-15																	
		g/mol	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l															
Tetrachloroethene (PCE)	166	2.5	0.02	0.5	0.00	1.5	0.01	8.0	0.05	14	0.08	10	0.06	0.50	0	7.5	0.05																
Trichloroethene (TCE)	131	48	0.37	0.5	0.00	41	0.31	1.5	0.01	67	0.51	10	0.08	0.50	0	9.0	0.07																
cis-1,2-Dichloroethene	97	600	6.2	0.5	0.01	370	3.8	1.5	0.02	170	1.8	10	0.10	28	0.29	5.5	0.06																
Vinyl Chloride	63	76	1.2	100	1.60	150	2.4	220	3.5	47	0.75	6000	96	57	0.91	2300	36.8																
Molar Sum		7.79				1.61				6.54				3.60				3.10				96.24				1.21				36.97			
Difference						-6.18				-2.94								93.14								35.76							

Net Change

119.78

	Molecular Weight	DPT3022				DPT3022				DPT3022				DPT3022			
		7-11				11-15				15-19				19-23			
		May-13		Mar-15		May-13		Mar-15		May-13		Mar-15		May-13		Mar-15	
		g/mol	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l
Tetrachloroethene (PCE)	166	2100	12.7	0.5	0.00	24800	150	12	0.07	35100	212	10	0.06	38600	233	5.0	0.03
Trichloroethene (TCE)	131	5000	38.1	0.5	0.00	4300	33	19	0.14	7600	58	10	0.08	6000	46	5.0	0.04
cis-1,2-Dichloroethene	97	750	7.7	0.5	0.01	1500	15	98	1.0	4200	43	70	0.72	900	9.3	5.0	0.05
Vinyl Chloride	63	290	4.6	2	0.03	250	4.0	670	11	840	13	4300	69	50	0.80	1300	20.8
Molar Sum		63		0.04		202		12		326		70		289		21	
Difference				-63.05				-189.80				-256.62				-267.59	

	Molecular Weight
	g/mol
Tetrachloroethene (PCE)	166
Trichloroethene (TCE)	131
cis-1,2-Dichloroethene	97
Vinyl Chloride	63

DPT3022			
23-27			
May-13		Mar-15	
ug/l	umol/l	ug/l	umol/l
23000	139	43	0.26
3200	24	1.5	0.01
320	3.3	1.5	0.02
25	0.40	35	0.56

Molar Sum

167

0.85

Net Change

Difference

-165.90

-942.97

	Molecular Weight	DPT3028				DPT3028				DPT3028				DPT3028				
		7-11				11-15				15-19				19-23				
		May-13		Mar-15		May-13		Mar-15		May-13		Mar-15		May-13		Mar-15		
	g/mol	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	
Tetrachloroethene (PCE)	166		0.00	0.5	0.00	56	0.34	0.5	0.00	41	0.25	0.5	0.00	0.5	0.00	0.50	0.00	
Trichloroethene (TCE)	131		0.00	0.5	0.00	1100	8.4	0.5	0.00	190	1.4	0.5	0.00	0.5	0.00	0.50	0.00	
cis-1,2-Dichloroethene	97		0.00	0.5	0.01	1400	14	17	0.18	2700	28	0.5	0.01	0.5	0.01	0.50	0.01	
Vinyl Chloride	63		0.00	0.5	0.01	760	12	20	0.32	2800	45	4	0.06	9	0.14	0.50	0.01	
Molar Sum							35		0.50		74		0.08		0.16		0.02	
Difference									-34.81				-74.28				-0.14	

	Molecular Weight
	g/mol
Tetrachloroethene (PCE)	166
Trichloroethene (TCE)	131
cis-1,2-Dichloroethene	97
Vinyl Chloride	63

DPT3028			
23-27			
May-13		Mar-15	
ug/l	umol/l	ug/l	umol/l
0.50	0.00	0.50	0.00
0.50	0.00	0.50	0.00
0.50	0.01	0.50	0.01
0.50	0.01	0.50	0.01

Molar Sum

0.02

0.02

Net Change

Difference

0.00

-109.23

Notes

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Molar Concentrations for Performance Indicator VOCs  
Southwest Hot Spot  
GSA Reclamation Yard (SWMU 10), Kennedy Space Center

	Molecular Weight	DPT3029				DPT3029				DPT3029				DPT3029			
		11-15				15-19				19-23				23-27			
		May 2013		Mar-15		May 2013		Mar-15		May 2013		Mar-15		May 2013		Mar-15	
		g/mol	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	
Tetrachloroethene (PCE)	166	5	0.03	0.50	0.00	19	0.11	1.5	0.01	890	5.4	5	0.03	3800	23	1.5	0.01
Trichloroethene (TCE)	131	1.5	0.01	0.50	0.00	38	0.29	1.5	0.01	2800	21	5	0.04	4300	33	1.5	0.01
cis-1,2-Dichloroethene	97	690	7.1	0.50	0.01	3600	37	120	1.2	6800	70	5	0.05	3100	32	1.5	0.02
Vinyl Chloride	63	150	2.4	31	0.50	1100	18	670	11	830	13	1100	18	200	3.2	120	1.9
Molar Sum			9.6		0.51		55		12		110		18		91		2.0
Difference					-9.05				-43.18				-92.41				-88.87

Net Change

-233.52

	Molecular Weight	DPT3031				DPT3031				DPT3031				DPT3031			
		11-15				15-19				19-23				23-27			
		May 2013		Mar-15		May 2013		Mar-15		May 2013		Mar-15		May 2013		Mar-15	
		g/mol	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	
Tetrachloroethene (PCE)	166	5	0.03	0.50	0.00	15900	96	22	0.13	33800	204	7	0.04	34	0.21	0.50	0.00
Trichloroethene (TCE)	131	280	2.1	0.50	0.00	7600	58	16	0.12	11200	85	3	0.02	330	2.5	0.50	0.00
cis-1,2-Dichloroethene	97	3900	40	0.50	0.01	6200	64	66	0.68	3400	35	30	0.31	310	3.2	0.50	0.01
Vinyl Chloride	63	1800	29	9.0	0.14	900.0	14	980	16	310.00	5.0	77	1.2	180	2.9	0.50	0.01
Molar Sum		71		0.16		232		17		329		1.6		8.8		0.02	
Difference				-71.05				-215.49				-327.50				-8.78	

Net Change

-622.81

	Molecular Weight	DPT3032				DPT3032				DPT3032				DPT3032			
		7-11				11-15				15-19				19-23			
		May-13		Mar-15		May-13		Mar-15		May-13		Mar-15		May-13		Mar-15	
		g/mol	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l
Tetrachloroethene (PCE)	166	<div></div>	0.00	0.5	0.00	1300	7.8	0.5	0.00	25600	154	1.5	0.01	9200	55	1.50	0.01
Trichloroethene (TCE)	131		0.00	0.5	0.00	4400	33	0.5	0.00	12600	96	1.5	0.01	15500	118	1.50	0.01
cis-1,2-Dichloroethene	97		0.00	0.5	0.01	3000	31	0.5	0.01	4500	46	1.5	0.02	3500	36	1.50	0.02
Vinyl Chloride	63		0.00	0.5	0.01	820	13	79	1.3	570	9.1	370	5.9	200	3.2	220.00	3.52
Molar Sum						85		1.3		306		6.0		213		3.6	
Difference								-84.13				-299.87				-209.20	

	Molecular Weight	DPT3032			
		23-27			
		May-13		Mar-15	
		g/mol	ug/l	umol/l	ug/l
Tetrachloroethene (PCE)	166	1000	6.0	0.50	0.00
Trichloroethene (TCE)	131	3000	23	0.50	0.00
cis-1,2-Dichloroethene	97	2700	28	0.50	0.01
Vinyl Chloride	63	730	12	0.50	0.01

Net Change

-661.58

Notes

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Molar Concentrations for Performance Indicator VOCs  
Southwest Hot Spot  
GSA Reclamation Yard (SWMU 10), Kennedy Space Center

	Molecular Weight	DPT3033				DPT3033				DPT3033				DPT3033			
		7-11				11-15				15-19				19-23			
		May-13		Mar-15		May-13		Mar-15		May-13		Mar-15		May-13		Mar-15	
		g/mol	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l
Tetrachloroethene (PCE)	166	0.5	0.00	2.6	0.02	3000	18	760	4.6	0.5	0.00	9.5	0.06	0.5	0.00	2.2	0.01
Trichloroethene (TCE)	131	0.5	0.00	0.45	0.00	620	4.7	200	1.5	0.5	0.00	1.8	0.01	0.5	0.00	0.45	0.00
cis-1,2-Dichloroethene	97	0.5	0.01	0.27	0.00	400	4.1	310	3.2	0.5	0.01	6.7	0.07	0.5	0.01	4.7	0.05
Vinyl Chloride	63	0.5	0.01	1.6	0.03	20	0.32	590	9.4	3	0.05	160	2.56	0.5	0.01	8.1	0.13
Molar Sum			0.02		0.05		27		19		0.06		2.7		0.02		0.19
Difference					0.03				-8.51				2.64				0.17

	Molecular Weight	DPT3033			
		23-27			
		May-13		Mar-15	
		g/mol	ug/l	umol/l	ug/l
Tetrachloroethene (PCE)	166	0.50	0.00	0.38	0.00
Trichloroethene (TCE)	131	0.50	0.00	0.45	0.00
cis-1,2-Dichloroethene	97	0.50	0.01	3.3	0.03
Vinyl Chloride	63	0.50	0.01	9.9	0.16
Molar Sum		0.02		0.20	
Difference				0.18	

Net Change

-5.49

	Molecular Weight	DPT3034				DPT3034				DPT3034				DPT3034			
		11-15				15-19				19-23				23-27			
		May-13		Mar-15		May-13		Mar-15		May-13		Mar-15		May-13		Mar-15	
		g/mol	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l
Tetrachloroethene (PCE)	166	1.5	0.01	0.5	0.00	5.0	0.03	1.5	0.01	120	0.72	2.5	0.02	5.0	0.03	1.5	0.01
Trichloroethene (TCE)	131	1.5	0.01	0.5	0.00	5.0	0.04	1.5	0.01	3400	26	2.5	0.02	650	4.9	1.5	0.01
cis-1,2-Dichloroethene	97	360	3.7	2	0.02	790	8.2	1.5	0.02	3900	40	2.5	0.03	2000	21	1.5	0.02
Vinyl Chloride	63	400	6.4	33	0.53	1200	19.2	330	5.3	840	13	450	7.20	740	12	210	3.4
Molar Sum			10		0.56		27		5.3		80		7.3		37		3.4
Difference					-9.58				-22.10				-73.03				-34.06

Net Change

-138.77

	Molecular Weight	DPT3035				DPT3035				DPT3035				DPT3035			
		11-15				15-19				19-23				23-27			
		May 2013		Mar-15		May 2013		Mar-15		May 2013		Mar-15		May 2013		Mar-15	
		g/mol	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l	umol/l	ug/l
Tetrachloroethene (PCE)	166	5.0	0.03	0.5	0.00	5800	35	14	0.08	16000	96	1.5	0.01	2	0.01	0.5	0.00
Trichloroethene (TCE)	131	5.0	0.04	0.5	0.00	2400	18	5	0.04	11000	84	1.5	0.01	0.50	0.00	0.5	0.00
cis-1,2-Dichloroethene	97	1500	15	0.5	0.01	3500	36	5	0.05	3800	39	1.5	0.02	0.50	0.01	1.0	0.01
Vinyl Chloride	63	1100	18	62	0.99	3000	48	2000	32	550	8.8	290	4.6	0.50	0.01	12	0.19
Molar Sum			33		1.0		137		32		228		4.68		0.03		0.21
Difference					-32.14				-105.19				-223.54				0.18

Net Change

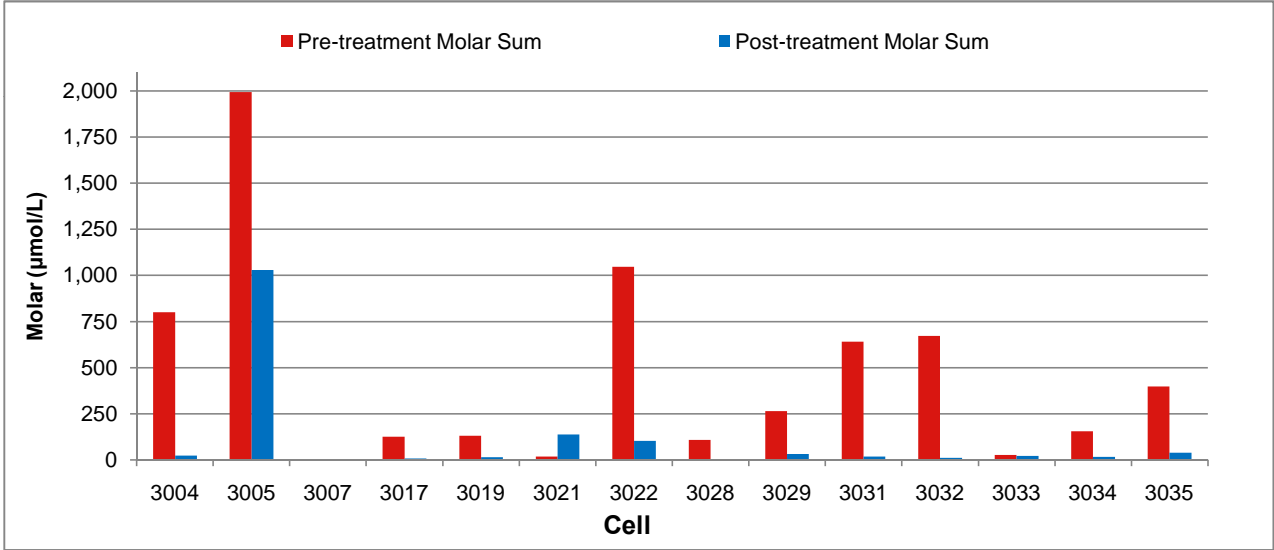
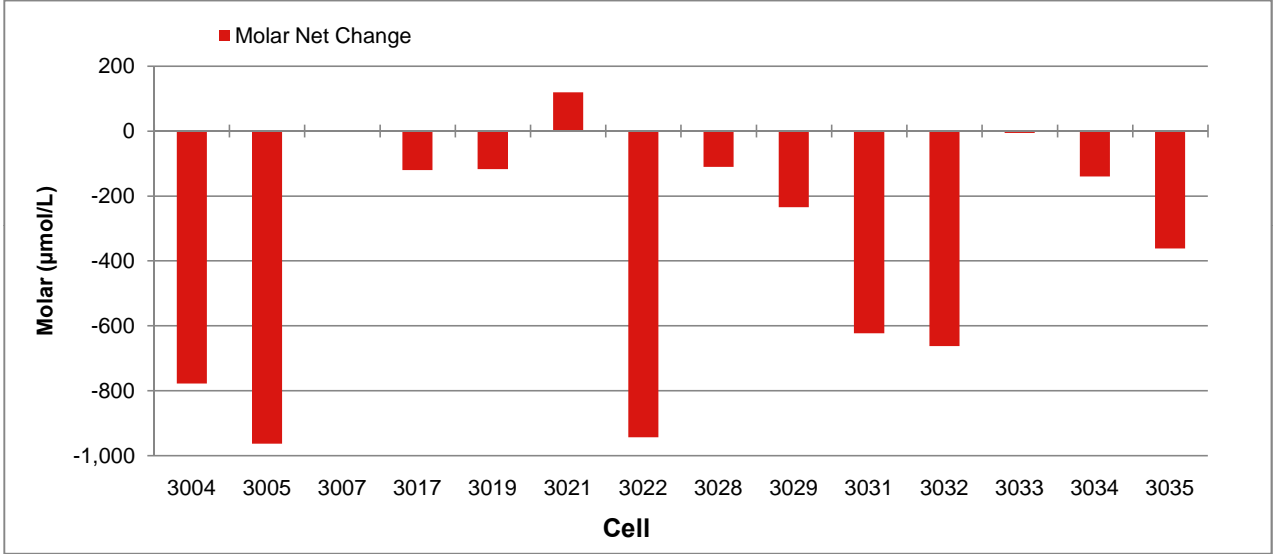
-360.68

Notes

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Molar Concentrations for Performance Indicator VOCs  
Southwest Hot Spot  
GSA Reclamation Yard (SWMU 10), Kennedy Space Center



Molar Concentrations for Performance Indicator VOCs  
Southwest Hot Spot  
GSA Reclamation Yard (SWMU 10), Kennedy Space Center

